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THE MILWAUKEE MEETING OF THE AMERICAN GAS LIGHT ASSOCIATION.

HOTEL PFISTER, MILWAUKEE, WIS., October 19th, 1905.

Dear JOURNAL: The first day's business proceedings of "the third-of-a century meeting" of the American Gas Light Association, which were concluded just before 6 P.M. of yesterday, were of a nature well qualified to show and prove that the "central body" of American gas men is losing neither in activity nor usefulness. Although rain was our portion in Milwaukee, the members and their guests had not much complaint to make on that score, for headquarters, meeting room and hotels, not to mention the omnipresence and excellent ways of working of the local committee on entertainment, made everyone not only comfortable but happy. The meeting was called to order shortly after 10 A.M. of yesterday, and it was a goodly attendance that greeted the President, Mr. E. G. Cowdery, of St. Louis, when he announced the opening of the business sessions. It is rather strange to write it down that Mr. Cowdery is of and from St. Louis, especially in Milwaukee, where his excellent and lengthy service in charge of the gas supply of that justly famed beautiful city, had made his name of a surety a household word. Still, as he is doing in St. Louis that which he did in Milwaukee, the honors which he gained in the latter are sure to be his portion in the former. Secretary Ramsdell, busy as ever, met all comers with tact and urbanity, and it gives me great satisfaction to announce that his objections to a re-election to the honorable and important, even though laborious, position of Secretary and Treasurer, were finally overcome. President Cowdery lost no time in introducing to the Association Milwaukee's "foremost citizen," in the person of its redoubtable Mayor, David S. Rose, who in hearty, humorous fashion welcomed the members and their guests to the hospitality and freedom of the city. The Mayor's words of welcome were neatly responded to by Mr. Arthur G. Glasgow, after which came the regular order of business. The report of the Council respecting new members recommended the placing on the rolls of 61 active, 32 associate and 9 junior members. These having been enrolled and welcomed, the regular report of the Council was read, and it was noteworthy for a recommendation that the Association shall do its own entertaining hereafter. Although the suggestion was "unanimously adopted," it may not be denied that more than one thought it would have been as well were the matter not touched upon. Secretary and Treasurer Ramsdell's annual reports were satisfactory evidence to the progress being made by the Association from material points of view, and Secretary Forstall's reports, concerning the year's working and operation of the Gas Educational Fund and the Practical Class, fully attested to the great benefits that came to many through the maintaining thereof. Vice-President Charles F. Prichard assumed the Chair, and President Cowdery read the annual message, which, as was to be expected, was closely followed by his hearers, and its many excellent, well put together points were eloquent of the thought which its framer had given thereto. The first paper read was that by Mr. A. E. Forstall, of Montclair, N. J., on "Methods of Charging for Gas," which led to a good discussion, and the termination thereof was ordered for the afternoon session.

The second session was called to order at 2:45, and the reading of the report of the committee on electrolysis, which was submitted by Mr. A. G. Glasgow, was had. The report of the committee was ordered printed for distribution amongst the members. Ex-President E. G. Pratt, on behalf of the committee to award the Beal Medal for the best paper read at the 1904 meeting, named Mr. B. H. Spangenberg, of Philadelphia, for his communication on "Consumers' Meters." The report of the committee named to consider the subject of unanimity or correlation of work amongst the various associations was then debated, and at the close thereof the following members were named to constitute a Committee on Organization of the American Gas Institute: F. H. Shelton, Wm. McDonald and H. L. Doherty. The election for officers resulted in the naming of:

President.—Charles F. Prichard, Lynn, Mass.
First Vice-President.—Charles R. Faben, Toledo, O.
Second Vice-President.—Alfred E. Forstall, Montclair, N. J.
Third Vice-President.—Arthur G. Glasgow, New York City.
Secretary and Treasurer.—George G. Ramsdell, New York City.
Members of Council.—F. H. Shelton, H. L. Rice, T. R. Beal, George McLean.

The discussion on the Forstall paper was then concluded, after which the paper on "Improvements to Date in Consumers' Meters," by Mr. Charles H. Dickey, of Baltimore, Md., was considered. It was a right instructive one, and the debonair gentleman from Baltimore is to be congratulated on his clever introduction to the ranks of paper writers. The discussion of that paper brought the day's business sessions to a close. In the evening a most enjoyable time was had at "The Deutscher Club," but as I understand you will later on have a special account of the entertainments and their pleasures, I will say no more about those things just now.—S.

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THURSDAY, 6 P.M., Oct. 19, 1905.

Dear JOURNAL: I would be very remiss indeed did I not mention the excellent work done by the Chairman of the Local Committee of Arrangements, Mr. E. G. Pratt, the active man in charge of the Milwaukee Gas Light Company, who extended to the ladies (of whom no less than 100 are present) the hospitality of his handsome home. The invitation was freely availed of, and no hostess could have acted with greater tact and dispensed more charming welcome than that so heartily shown by Mrs. Pratt. And this is not in any sense to be taken as meaning that Mr. Pratt's aides on the committee have not done their full share in assisting. They have simply been unremitting in their attentions to the many who are sharing in the work and pleasures of the meeting. The business sessions of the day were commenced at 10:30 A.M., and immediately after the call to order the President introduced Prof. B. H Meyer, of the Wisconsin University, whose excellent lecture on the "Relativity of Economic Institutions" was listened to with close attention. The Professor was heartily applauded when the lecture was ended, and he well deserved the vote of thanks passed to him on motion of Mr. Paul Doty. The splendid paper on "Taxation of Gas Companies," by Mr. George McLean, of Dubuque, Ia., led to a rousing discussion, and a draft on the contents of the Question Box carried the session to the noon adjournment. The courtesies of the Milwaukee Club and of the Milwaukee Athletic Club, which were freely offered, were as freely availed of, and the Milwaukee Gas Light Company, was also in abundant evidence as a hearty host. The afternoon session which was convened at 2:30 was opened by the consideration of the paper on "High Pressure Distribution to Date," by Mr. H. L. Rice, of Aurora, Ills. The author has taken good rank with those who have paid much practical attention to this matter, and the report of his experience in the premises up-to-date was rewarded by a fine discussion. The next paper was on "Condensation," prepared by Mr. James S. McIlhenny, of Washington, D. C. It was a practical thesis, and its discussion was unfortunately cut somewhat because of the lateness of the hour. The paper by Mr. B. F. Lyons, of St. Louis, Mo., was read by title only, and this completed the regular list. The committee to name next place for meeting deemed it best to withold the report until after the Ohio and Western Associations Conventions, next March and May respectively, have been held. The sad news of the sudden death last Sunday of the well-esteemed Treasurer of the Washington (D. C.) Gas Light Company, Mr. John C. Poor, caused many expressions of sorrow and sympathy, for he was a man of men. Although the weather has been very much on the rainy order, the "softness" thereof did not hamper the attendance in or out of meeting, and the Milwaukee convention must be proclaimed a pronounced success. This afternoon the ladies were entertained at the Country Club, where an elegant luncheon was served, and to-night they will visit the Davidson Theater, there to witness the play of "The School Girl," and later on to have a "snack" at the Pfister. The sterner sex will share in a banquet to-night at the Pfister, and judging from the advance rumors respecting the affair there is no reason for doubting that all will be well pleased and well served. The outing arrangement for to-morrow (Friday) will be followed out according to the programme announced in the official notices. Not the least interesting number on the list is the visit of inspection to the mammoth and modern works of the Milwaukee Gas Light Company.—S.

BRIEFLY TOLD.

DEATH OF MR. JOHN C. POOR.—Mr. John C. Poor, Treasurer of the Washington (D. C.) Gas Light Company, died suddenly the afternoon of the 15th inst. The cause of his death was acute indigestion, and the appalling suddenness thereof may be well understood when it is said that the attack beset him while riding on the Chevy Chase road, and that in 20 minutes the end was at hand. He had been in the service of the Company for many years, and no other man in business in Washington was more respected and esteemed than Mr. Poor.

THE MICHIGAN PAPER ON NAPHTHALINE.—We call the attention of our readers to the excellent paper on naphthaline read at the Michigan meeting by Messrs. Alfred H. White and David H. Clary, and published in this issue of the JOURNAL. The results of practical tests made by them seem to overthrow all previous theories in regard to the temperature at which tar absorbs this "will o' the wisp." Up to a few years ago, a long foul main and plenty of condensers were used to throw down the tar gradually and at the same time permit the cold tar to absorb naphthaline. More recently the P. & A. tar extractors were installed to relieve the gas of tar while the tar was hot. These tars and aqueous vapors contained the largest per cent. of the heat units, so that the rest of the condensing apparatus was not burdened with cooling off the tar. It was then thought that naphthaline was formed quite as frequently with the P. & A. as when it was not used. Previous to this design, however, came the hot scrubber which in light of the new discovery, that tar absorbs naphthaline better when hot than when cold, is better fitted for the extraction of tar if naphthaline is to be considered, although this machine does not seem to take out as large a portion of the tar as the P. & A. It would then seem to be necessary to use both machines, the P. & A. for extracting all of the tar, and a washer following same to take out the naphthaline, which washer should be supplied with the hot tar extracted by the P. & A., the hot tar being changed as soon as it is nearly saturated with naphthaline. This apparatus and sequence of apparatus are used abroad, but the washing liquid is light oil.

[Continued from page 620.]

THIRTEENTH ANNUAL MEETING, MICHIGAN GAS ASSOCIATION.

HELD AT THE STEVENS BUILDING IN DETROIT, MICH., SEPTEMBER 20, 21 AND 22, 1905.

FIRST DAY—AFTERNOON SESSION.

Discussion on the Report of the Committee on Standard Sizes of Coke and Each Producer's Market Therefor.

The President—I think that a rough summary of Mr. Ewing's report would be that everybody ought to sell all his coke in his own bailiwick and a little more. If there is anybody thinks that they ought not to, I think we ought to hear from them. This question of size, it seems to me, to be one that is not a case of local conditions, but is one in which uniformity could very well be effected by all the companies in the State. The paper is open for discussion, and I hope it will have a thorough one.

The Secretary—I would like to ask Mr. Ewing—there is no scale shown on the drawing—of the coke screen which he presents with the report. What is the best height for that screen, and how long those screen bars should be?

Mr. Ewing—I think possibly Mr. Dewey can give you the exact length of those screen bars, because he is closer in contact with it. As I remember it, the bars were 8 feet bars, and were put in at about an angle of 45°.

Mr. Dewey—I do not remember the exact figures. It is only a short time those figures were gotten up. I do not believe they are quite 8 feet long, though. If anyone desires to know that information exactly I would be glad to get it for them, and give it to them to-morrow. We have it in detailed drawings.

The President—A screen about 8 feet?

Mr. Dewey—The screen bars; they vary in length. The furnace bar is longer. I would be pleased to get the whole information. If you want it Mr. Douglas, I will get it for you.

The Secretary—I would be glad to have it, Mr. Dewey.

Mr. Dewey—All right, I will hunt it up for you.

The President—Mr. Frazer, no coke for sale out there at Grand Rapids?

Mr. Ewing—I would like to hear some opinions in regard to the names, because a good many have said to us they thought we should adhere to the same names we have always used, there was no reason for change, and as we have recommended a change from some of the others to a standard name, I would really like to have some expression of opinion, and I would like to have an expression as to what the coke condition is to-day, who has more coke than he can sell in his own market.

Mr. Knight—I think that the suggestion of adopting the names "egg," "stove" and "chestnut" is a splendid one. I think that is fine. We have not any more coke than we hope we can sell. It is not time yet to tell. I would like to ask Mr. Ewing about this last paragraph in his paper. He says: "In the past year there have been instances in which coke was shipped by gas companies to other cities having gas plants and there retailed by dealers at 50 cents less per ton than was obtained in the home market. Coke, unlike gas, is an open market product, and conditions, not inclinations, regulate prices. The difference of this course was that cutting the local retail price hurt the business rather than extended the market." I do not quite seem to understand that. I want to know if Mr. Ewing thinks it would have been better for the gas company who did that to reduce the price of its coke and sell it in its own town, and wouldn't he prefer to sell his surplus in his own town, assuming that he could sell it if he reduced the price low enough. What would be your judgment about the advisability of doing so?

Mr. Ewing—First of all, I do not think it is necessary for him to sell it out of his own market. In the next place, I think that he should have obtained the same price in that foreign market that the local company was obtaining. There was no necessity for his making room for coke, because he really did not. If there was room for the coke, he could have sold it at the other fellow's price, because it had to be consumed; and if we are going to use markets near by us as a dumping ground, I think that we should extend to that company the courtesy of letting them know that we were going to put in some coke there; that it would not hurt their condition at all, because if you can say to a man that you have an opportunity to put a few cars in his market, with no damage to his local trade at all, it is not going to affect him; it may be the best he can get himself. I have in my mind Adrian, for instance.

There is one dealer that buys coke outside of town; he does not buy much, but he insists on buying that little out of town. We might just as well get the same price as the local company is charging. We gain nothing by cutting the price. That is why I say that I would add that 50 cents a ton to his price and spend it in advertising at home. The next year he would not have that coke to send down there.

Mr. Knight—I understand that there are some large gas companies which job out their coke—sell it to some dealer who guarantees to take it all and sell it at some price—I suppose at a profit. They have at times been bothered to get rid of it, and they have invaded the local market where gas companies had coke to sell and prevented their selling all their coke and maintaining a decent price. It is unreasonable and unfair to do the thing which you say has been done here; and the simple result finally, if carried clear to the end, would be one man shipping his coke to the market of the other, and he shipping back, a very bad condition of affairs. The question is, how can a gas company sell its coke in its own town at the best price obtainable, and sell it all, provided he can sell it all, unless he reduces the price and makes it an object to the people so use it. Some people won't use it at a slight difference of price. I think we ought to put an attractive price on it. It was not a very satisfactory sentiment we aroused in our town when we shipped coke out of town for less than we were selling there. I was rather opposed to doing it.

The President—Do they burn anything but slabs up in Saginaw?

Mr. Cobb—Saginaw and Bay City; we burn a few slabs and it is pretty good fuel. I think Mr. Ewing spoke about shipping around the State to other towns. I think that happened more two years ago than it did last year, caused no doubt by the slowness of the fuel market. I know that we sold coke in another man's territory, and I know the Detroit Gas Company did the same thing, because we had some of their coke up in our town, and we know where it is at. Last year I do not think that any of the gas companies around the State had any such trouble at all. Do you know of any last year?

Mr. Ewing—I had a few letters in regard to it last year.

Mr. Cobb—Your names that you have selected, egg and stove and chestnut are just the same. The only change in that is the word, chest and nut. We always called it egg, stove and nut.

Mr. Ewing—Nut coal is smaller than chestnut.

Mr. Cobb—It means the same thing. It would not mislead. Others call it chestnut, we call it nut.

The President—What is done in Grand Rapids? We have had a State Fair out there; did you warm up the grounds with coke?

Mr. Cantrell—I will have to tell you a good joke about that. This came to me as a story. They had an exhibit there at the State Fair, and for some reason or other the stove that was installed there did not have sufficient draft. There was something wrong. The coke was put there, ignited, and started to smoke; like to have smoked everybody out of the grounds to start with. There was quite a josh about it for a while until they got the damper on. In Grand Rapids, they market practically all the coke locally. The officers of the company very much favor the adoption of these three different terms for sizes. From what I have heard them say they are very much in favor of it to comply with the same sizes of hard coal.

The President—Mr. Stirling did you get rid of all your coke?

Mr. Stirling—Yes. We do not know anything about crushing, for we have a market for all of it without crushing, from the retorts.

The President—Is there any sold in town outside of what you make?

Mr. Sterling—Very little. The Detroit Company shipped some over two years ago.

Mr. Freese—I have not much experience in the coke line. I know that the coke propositions of some companies seems to be a hard one. The plants at La Porte, Ind., I know are piling up their coke in great piles. I could not give you much information on the subject of coke.

The Secretary—I want to agree with Mr. Knight in that I think every company should market practically all of its coke at home, and market it at a price where it can sell it at home. The market should be studied, and that price adjusted so as to compete with the other fuels. I do not believe it is just; I do not believe it is good policy to charge one price for your home consumption and another price for your shipments.

Mr. Lathrop—If any of you gentlemen want to see some really good coke, and lots of it that is going to be marketed locally, we would like to have you come down while you are here and see what we have down there. We intend to market it all over.

The President—You are interested in the production of coke as coke, rather than gas, Mr. Blauvelt?

Mr. Blauvelt—I suppose probably our coke gets out of the city, and no particular city has been used as a dumping ground. It has been sold through local dealers, and they base the price on what Detroit dealers pay. At the present time coke that is shipped to the outside market is bringing a better price F.O.B. our yard than the coke we are selling in Detroit, which is a very satisfactory condition of affairs. I think this coke market business has never been worked up anything like it should have been. I don't think the Detroit Gas Company has half as much trouble in marketing coke as before the Solvay Process Company came into the market with a tonnage rather more than theirs. I know that the Solvay Process Company last year was able to market locally, and at a satisfactory price a much heavier tonnage than they did the year before, and our stock piles at present are very much less than last year; and also made up of the sizes which are marketable at a fair price. In regard to those sizes, our Company uses different sized screens. We screen with a rotary screen, as we find it pleases our customers rather better. There seem to be certain advantages in the use of the rotary screen. Our sizes, after passing through the crusher, are made up as follows: I may say, we make 3 sizes, egg, nut and pea. We find the market for stove is rather small. The simple result was we shipped, about a year ago, some 6,000 tons of stove coke which we had great difficulty in disposing of. This year we have the same quantity of coke, but it is all nut coke, and it is going out at this time of the year faster than we can make it. We reduced our stocks in the month of August. We have just held our own thus far in September, and we have reduced our stocks a good deal in egg. Our nut coke is what passes over a ¾ inch and through an inch and a half. Our pea passes over a ¾ and through a ⅜. That gives us a size which does not compete with anthracite, and does compete with soft coal, and is sold at retail at about $3.30, and is used quite extensively in the Polish and Hungarian settlements. Our egg is anything that passes over a 1½ square opening. Our breeze, up to a very recent period, has all been shipped into Western markets, principally Chicago, where it has been used by brick makers, and zinc furnaces and so on; and we got about the cost of handling out of that. We are now building a plant, and as in the experimental stage we have turned out 20 or 30 tons of briquettes, we will have a capacity of about 5 tons an hour, and we will take care of all our breeze, and if the market for briquettes is suitable, we will crush up the pea coke, and turn that into briquettes. I don't know as I have anything more to say; but I would like to say the same as Mr. Lathrop says, if you want to see some *really* good coke, we will show it to you at the Solvay Process Works. (Laughter.)

The President—I think it might be interesting if you would give an outline of that briquette plant and the product. It is a new thing here.

Mr. Blauvelt—That briquette plant is yet somewhat undeveloped. Instead of trying to work entirely on original lines, we took up the study particularly to find out what had been done over where they had coke breeze as their staple, which had to be disposed of. The only machines which we could find any record of working successfully, was an English press, which made a large brick about 6 by 9 by 3½, I think. There was a press in Scotland using 8 or 9 per cent of coal tar pitch, about 25 per cent. of coke or coal, the balance made up of breeze. We realized that we could not get the American householder to use a brick that was as big as a Webster dictionary, to go down cellar, crush it and throw it on the fire, and we had to insist upon smaller briquettes; and the briquettes we have made are 3-inch cubes. They are made under very heavy pressure, so that the density is almost the same as anthracite. Thus far, we are not on the market, but we have made a few tons, and we are experimenting in stoves and furnaces out there at the works. It looks to us as though it would market at very close to the same price as anthracite. We want it to be so that it won't hurt the coke market and will give us a means to get rid of our breeze. We find by using a binder, a pitch which has practically no ash, and the soft coal which has only about 3½ per cent. ash, we can get the mixture down where the ash is about 10 per cent., which is about the same as anthracite coal. I have some samples in the laboratory to have calorific determinations made from, and I think it won't vary materially from anthracite. My own opinion is, that our briquettes are a little bit large except for large house furnaces; but my hope is in the future we can change our moulds and use about a 2-inch cube, and that would replace egg coal.

The President—Do you anticipate any breakage through use of a cube?

Mr. Blauvelt—The thing that has surprised us much has been the small amount of breakage. They are delivered on a coal conveyor about 200 feet long. By the time they get 50 feet from the building we have a wagon located there and a shoot that was about 12 feet long,

and at an angle of about 45°, and struck in the wagon that was located there. I don't think there was ½ of 1 per cent. breakage when the machine was working. We can take and throw them against the side of a house, or around on the floor, and hardly anything breaks. The corners are champered in a machine. If they were sharp corners they would break. I don't think the breakage would be any more than anthracite coal with the ordinary handling.

The President—It seems to me in this question a market for coke, that it is very much the same as other classes of merchandize, and that in dealing with the subject we have got to divorce our minds from any preconceived ideas in the disposition of gas. The idea of maintaining a price, we will say, at a fixed price, agreeing on a price or anything of that sort, never seems to me will work out, when it comes to what are open market products absolutely. I think we are at liberty to sell our coke at any price that we may see fit; that is to say, it is a different character of service altogether from the delivery and sale of gas. There is no question in my mind that each market not only can but ultimately will absorb more coke than can be produced in serving that community with gas. It is going to cut in to the hard coal trade in this section of the country. There seems to be no disposition to reduce the price of hard coal; the quantity of it seems to be more or less limited, and there is a market for all which the owners of those properties care to produce in any given year at those prices. Now there is a growing sentiment against the destruction of the beauty of our cities with the smoke nuisance. There is the further fact that the old methods of coke producing are all going to be superseded. The old beehive processes are going to superseded. It does not make it look beautiful for the tar market, and probably it is in as bad stead as it can get anyway, but as soon as this coke gets on the market it will curtail the domestic use of soft coal, and there will be a tendency to curtail the use of it in office buildings and all places down town; and I think there is going to be an enormous extension of the use of coke. I think we are only just scratching the surface at the present time of the quantity of coke that a community can absorb. Now in some communities, where they have been hammering away at the proposition for a long time, they have spent a considerable amount of money in educating the people; they have carried on a campaign which it has even been suggested at first was worth money from a capital standpoint. In other communities they have not developed their market to the same extent; they have not got the people to use it; they have been accustomed to hard coal and they are still burning it. There is very little difference, as far as I have been able personally to observe, between furnace coke and hard coal, and at a very moderate difference in price coke is more desirable. If that be the case, it is only a question of educating a community until they are going to use this product. If a company has been making, let us say, water gas for a number of years and the people have been accustomed to heating their houses with hard coal, it is going to take some time for them to become accustomed to a change in fuel, and that company for some years at least will have more coke than it apparently can dispose of locally. Under such circumstances, it seems to me, a company might as well make a low price locally as to dump it in some developed territory, because the farther they go the worse off. If they ship out of town they are selling at a low price, because there is the freight and dealers' profits against them, and that condition will continue; whereas, if they will educate their own market and sell it at low prices and get the people using it, gradually they can run their prices up, being under no obligation to maintain a low price. When they get the demand they will get higher prices, because it is an open market product. If they do not want to buy here they can buy somewhere else—it is not like gas. We will now take up the paper on

TAR BURNING IN GAS AND ELECTRIC PLANTS,

by Mr. A. R. Field. Mr. Field is not here and I will ask Mr. Schwarm to read the paper for him.

There are probably but very few tar producing plants in the country that have not at some time made a more or less thorough attempt at burning at least some portion of their product.

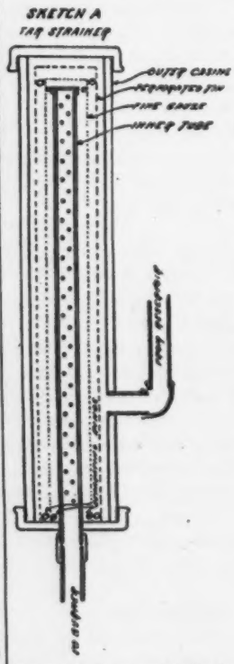
Some few have reported that they were satisfied with the results obtained, but when an attempt was made to find out what they were doing and how they were doing it, the available information began to narrow down remarkably, until the seeker after knowledge was generally forced to content himself with the most incomplete descriptions of burners and methods which, when they came to be put into operation in his own plant, failed to show the desired results, and after making such changes as suggested themselves without getting any nearer to the desired end, the matter was in most instances allowed to drop and the sticky fluid continued to accumulate until in many small plants the tar wells, any extra tanks that the works might possess, all the barrels they could store, and finally the holder tanks, were filled with tar.

To come down to our own experience, when it became impossible to find a market for our tar, unless we were willing to sell the entire yearly production at 1½ cents per gallon, we began to talk seriously of trying to use it for bench fuel; an idea which was fostered by the fact that we had built up a very fair market for our coke.

Our foreman, an intelligent young Welshman, with whom we took the matter up, grinned and remarked that when he first came to the plant they were burning tar very successfully, so far as getting rid of it was concerned, in fact, it burned fine, but it took rather more coke than where the benches were fired without it, and when they burned it under the boilers it melted out the grates and the coal consumption was as great as though no tar was used, but still he was quite willing to try any scheme that offered a fighting chance of preventing our being buried in tar.

After going around to 3 or 4 plants where they were burning tar, we found that "were" was the proper word when it applied to some time in the past, and all we could unearth were parts of piping schemes, bad burners and disgusted foremen and operators, and the net result of our looking around simmered down to the conviction that the majority of the failures was due to the fact that in most works tar was tar and that whatever effort they expended was always along the line of arranging piping and buying or devising burners with little or no regard to preparing the tar so that it would flow smoothly.

We started by building two strainers (see Sketch A) as follows: Two 18-inch lengths of 3-inch W.I. pipe were cut off and threaded on each end. A 3-inch cap was bored in the center and tapped for a 16-inch length of 1-inch pipe, which was bored full of ¼-inch holes and screwed through the cap from the inside, then the 3-inch cap was made upon one end of one of the 3-inch pipes which had been tapped to receive a ¾-inch inlet about 4 inches from the capped end. Cylindrical strainers, one of perforated tin and a finer one of brass gauze (such as is used for dairy screens), were slipped concentrically over the 1-inch outlet, but were held from making contact with it or with each other, by rings soldered at their tops and bottoms. Then the top of the 3 inch pipe was loosely capped to exclude dust but left so that the screens could readily be removed for cleaning.



One of these strainers was placed on the inlet of the tar reservoir and one between the tar reservoir and the burner. The tar reservoir was a steel tank holding 78 gallons and containing a small steam coil so that tar could be maintained at a temperature of from 100° to 110° F.

We had invested $15 in a well-known tar burner ("Parsons") in which the tar was brought to a central circular orifice by gravity, and there it was suppose to ooze out into a circular jet of steam which surrounded the tar outlet; as an atomizer it was all that could be desired, the flame was smokeless and intensely white and within 2 hours the settings were dripping fused firebrick. Then the burner was tilted down and the flame baffled on a pile of broken brick thrown in onto the grate bars. This gave a better distribution of heat, but though we carefully experimented with the burner for nearly 3 weeks, we were not able to strike a combination that would heat the bench evenly and the yield per mouthpiece was correspondingly low.

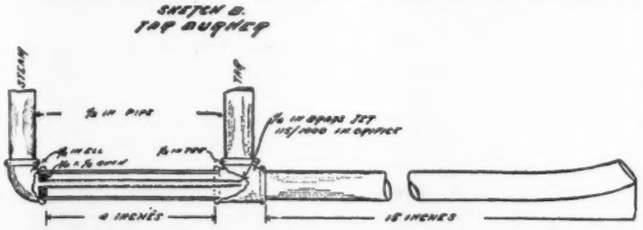
The objections noted were bad enough, but added to this we found that in spite of the care with which we strained and maintained an even temperature on the tar, two men and a small boy could not keep that burner going and that in the face of all we could do it would stop at intervals of from 15 minutes to 2 hours.

In the burner mentioned, the flow of tar was regulated by a needle valve and, as we were cutting the consumption as low as possible, the valve was nearly closed and what tar did pass was forced into a very thin sheet surrounding the needle. Thinking this might account for its stopping, we carefully filed a slot of circular cross section lengthwise of the needle, thus allowing the necessary amount of tar to flow n a solid body. This was a great help, but, as the burner did not

operate on the siphon principle and there was no pressure on the tar except such as was afforded by about 6 feet of head, the trouble was not entirely eliminated, and as coupled with this we were unable to get anything like reliable operation, the results were far from satisfactory or economical.

As will be noted, the results obtained up to this point were entirely negative, but they have been given with the idea that it is frequently of value to know what not to do.

The first favorable results which we attained in burning tar were with burners which were built of pipe and fittings, and from first to last, good, bad or indifferent, they have all operated on the ejector principle as this will largely eliminate stoppages due to slight changes in the consistency of the tar, and after many changes we have finally settled on the simple form (see Sketch B) which we are using at present



This burner can be built for 25 to 30 cents, including labor, and is installed through the center of 4½-inch opening in firing door, which we have bricked up with the exception of opening mentioned.

The burner never stops up, requires practically no attention and running the tar through one screen having 16 meshes to the inch is all that is necessary, as the burner exerts considerable suction and has no constricted tar passages.

We are regularly carbonizing from 4½ to 5 tons per day of 24 hours with an average consumption of 138 gallons, or about 37 gallons per ton; on tests this can readily be reduced to 134 gallons, but the average running will show somewhat higher.

The figures given are hardly fair to the tar burner, as we find that the men pick lump coal for the coal fired benches and give the tar fired bench all the fine or wet stuff that remains. This can be done as the burner seems to have no trouble in holding up the heats.

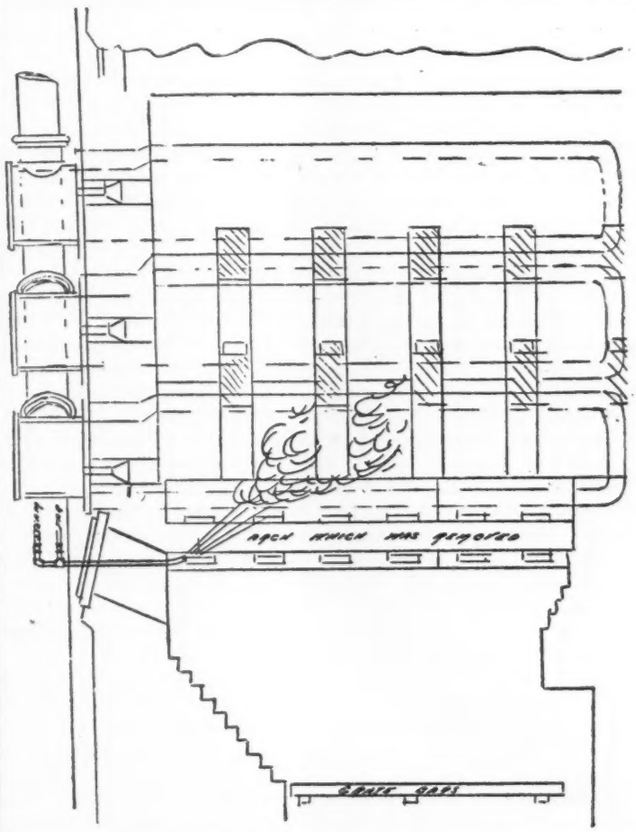
It may be well to note that in using this burner we found it necessary to get rid of several preconceived ideas. In the first place, we used about 220 gallons of tar per day in the endeavor to get a white flame and still keep up the heats. By reducing the amount of steam admitted, we found that the tar could be reduced and no cooling of the bench was noticed. This was kept up until the burner was doing better work on 138 gallons than it did on 220 gallons, but the resulting flame from which the most economical results will be obtained is far from white. In fact, it is a rather slow, reddish yellow, but does not smoke or soot up the setting nor is any amount of smoke perceptible at the stack.

The setting with which the experiments were made is a Parker-Russell Company standard half depth, semi recuperating bench of sixes. We removed the arch and directed the flame upward directly among the retorts and against the saddles at a point about 3 feet back from the firing door, the flame first appearing on line with the lower retort, but in 4 months' run there has been no sign of melting them down or in any way working undue injury to the bench.

The tar supply is regulated with a ¼-inch stove cock as shown in sketch C, as this enables the operator to observe the amount of tar he is feeding. No breeze or other fuel is used and no firebrick is necessary to protect the grate bars, as the flame is up among the retorts instead of being down in the furnace.

To burn tar in our electric plant a burner was constructed so nearly like the one which was later described by Mr. George Reed, of Binghamton, N. Y., in figure 15, page 570, American Gas Light Journal of April 10, 1905, and also on page 175, *Progressive Age* of April 15, 1905, that the description and drawing given will cover it, except that we used no fittings larger than ¼-inch and did not draw down or contract the nozzle which was inserted through a ¼-inch hole drilled in the boiler fronts above and in no way interfering with the firing doors.

The above arrangement made it possible to change



from coal to tar at a moment's notice and in carrying a peak load we sometimes used both until we found that the tar burner alone was capable of making more steam than we could use.

The boilers are Class E, Sterling water tube, rated at 202-horse power having 2,019 square feet of heating surface and 42.66 square feet of grate surface, stack draft about 6/10 inch.

Tar used weighed 9¼ pounds per gallon and the average evaporation was 12 82 pounds of water per pound of tar. This was largely due to an unfavorable load factor during several hours of the day, as full load tests indicated an evaporation of nearly 14 pounds of water per pound of tar.

The tar is pumped without any strainers whatever, direct from the tar well to the burners by a small Marsh steam pump working under a pressure of from 125 to 170 pounds per inch. It will be noted that the tar pressure must be higher than the steam pressure used, and in our case this varies from 100 pounds during light loads to 150 pounds at the peak.

The flame is directed downward by bending the nozzle so that it will strike the grate bars about 3½ feet back from the furnace doors, where it is received on a bed of about 8 inches of ash, clinker, coal or breeze. The ash pit doors are left open and ash pits are filled with water to prevent warping the grates, but as there is very little draft through the mass of material on the grates the principal air supply is an overdraft admitted through shutters in the firing doors.

The burners rarely clog and require a minimum of attention. Flame is one whirl of intense white, there is no smoke and the entire installation can be made for $5 per boiler, exclusive of pump, which in our case cost about $31 and is large enough to supply 2 boilers to their greatest capacity.

In figuring the fuel value of tar against any fixed price per gallon, it must be remembered that the price received is never net, since an allowance must be made to cover pumping, barreling and carting the product. In burning tar, these costs, with the possible exception of the pumping, can be eliminated and even this may be done away with in firing benches, as the tar can readily be taken direct from the hydraulic main to the burner by the installation of a simple tank separator provided with suitable overflow connected back into the main leading to the tar well.

A sketch showing a simple arrangement, devised by Mr. F. C. Slade, is shown on page 610, American Gas Light Journal, of April 17, 1905, and though differing considerably from the one we are using, will serve to convey the idea and will undoubtedly work as well.

Discussion.

The President—Tar burning seems to resolve itself into whether you can get more out of it as fuel or as a sale product.

Mr. Barthold—The whole secret of burning coal tar is getting a smooth flow, and most attention must be paid to that end of it, getting it to go to the tar burner well strained and at the proper temperature. The next it must be sprayed into the furnace at the proper temperature. In the benches you have the burners surrounded by incandescent fire-brick. In most boilers you do not get this condition, but you do in the Stirling boiler, where we have an incandescent arch above, and it is an ideal boiler to burn tar on. Any Dutch oven would answer the same purpose, but you must have the boiler surrounded by incandescent fire-brick, as it must be at a very high temperature. We tried, I think, three patent burners for coal tar and none was successful. We had to make up a burner of piping and fitting. I noticed that the amount of tar that we used replaced fuel at $3, at about 2 cents per gallon. The best you can do is to burn the tar, and taking the greatest pains possible it destroys the benches very rapidly, and it is safe to say that it cuts its life in one-half, and that and the attention required and extra expense about ½ cent a gallon. We burned 500 barrels one year and obtained about 3 cents a gallon for it. We deducted 5 cents from that for extra wear and tear on the benches and expenses. We always use coke with ours. Mr. Whalen, at Jackson, burned some tar, and the way he was burning it I think he was getting the best results as far as wear and tear on benches is concerned. As far as I saw it was not any harder on the benches than coke or coal, and he has had considerable experience on this subject, and also Mr. Traver. I think he has had a good deal of experience in burning in boilers.

The President—What kind of a strainer did you use, Mr. Barthold?

Mr. Barthold—We had a measuring tank that held about eight barrels, and it flowed from that to an ordinary barrel. This barrel had a float in it that regulated the inlet cock, keeping it a certain height, and that gave a constant head on the burner. This tar coming into the barrel went through several screens, and the barrel had a coil in it to keep the tar at the proper temperature. We use a wire screen. We first tried gunny sack, but it clogged up too quickly. I think we had several layers of ordinary window screen.

The President—You found no difficulty with tar going through ordinary window screen?

Mr. Barthold—Not with the home-made burner. We use six or eight thicknesses of screen.

The President—You figure 2 cents a gallon, with fuel at $3 a ton? That is a fairly high price for fuel.

Mr. Barthold—$3 replacing coke or coal; that is a fair price.

Mr. Whalen—We used a tank that held about 300 gallons, I believe, and we have a 2-inch pipe leading from that to four benches, and through that 2-inch pipe I had a ¼-inch pipe that carried a small amount of steam through the 2 inches, and the feeders were taken off the benches, and this steam pipe inside kept the tar about the same temperature all the time. Then we had a strainer on the inlet tube from the pump. This tar fed into barrels upstairs where the operator could see it, and we had strainers, brass, regular wire screens on the top of those barrels where the tar went through. This prevented dust from getting down and plugging up the burner. We tried all sorts of schemes to keep that tar from plugging up. We had trouble in the fire box, that it would stop it at the end of the burner and clog up and not run, when we got it too hot or too cold; but by a small amount of steam going through the ¼-inch pipe it kept the tar at the same temperature all the time, and fed all right. Our trouble then was in the fire boxes. If you got the pipe too far in the fire box the pipe would get hot, and the tar would pitch up on the end of the burner and clog up. I cut that off entirely and I used an open piece of ordinary pipe, and I put that right underneath the fire pot of the door, just extended the tar pipe through the wall, and it never got into the fire box far enough to get hot. We used no fuel at all but the tar. We used a little breeze, probably 100 pounds a day in each bench. This tar was scattered inside of the wall all along on top and in the arch box, but the pipe was out, and we had no white heat at all in the fire box; we had nothing more than a cherry red in the fire box; and I gave it a large amount of secondary air from the bench. This tar went through from the fire box, a regular smoke, and the secondary air took care of it after that. It did not affect the settings any, and we used about 135 gallons for a day of 24 hours—that is about 100 pounds of solid fuel—but we could not do as well with the tar as we could with the coal fuel. The tar would not run as constantly and give the steady heats; we could not decarbonize as much coal. We would run about 2,150 pounds on six benches for four hours, and sometimes the heats would be up and sometimes down. We could not run as uniformly with tar as with coal. I figured that coal at $3 a ton took about 300 pounds to the ton carbonizing the coal, and took a great deal more coal out of the coal fire box than the tar fire box, and I figured tar is not worth a great deal. To decarbonize a ton of coal we used 45 cents worth of coal per ton, and 37 gallons of tar. You would only have 45 cents of fire if you used 37 gallons of tar per ton of coal carbonized; and to use 45 cents worth of coal to carbonize, you have only 45 cents for 37 gallons. And we have extra labor attached to that, and there is some more cost to the bench. The bench won't last as long. I figured in all that your extra labor will cost you a cent more. Take the way he is using it, 4½ tons of coal to 5 tons per day of 24 hours, and compare that. Compare 5 tons of coal for 24 hours with the 13,500 pounds of coal for the 24 in the coal fire box, your labor costing 1½ cents more, and add that on to the 37 gallons, and I don't think you will have much left if you can decarbonize that coal for 45 cents.

The President—Mr. Whalen has gotten unusual fuel results, and he has carbonized 6½ to 8 tons on a bench of six every day. Three-quarter tube?

Mr. Whalen—Yes. That is comparing with tar fuel.

The President—That is certainly getting good results.

Mr. Owens—I found the greatest trouble entirely with tar burning was to get it to run constantly. If we can get something that will keep the tar running freely all the time, then we can get down the cost of it; we can use a great deal less if we can keep it going all the time. If running too fast and you run it slower, the heats will go down, and you have to lower the charge to get them up again. If we can get something that will make that tar run constantly, a great deal less can be used, because when the tar stops running the steam keeps going and clears the bench off. It is a matter of getting that tar to flow with a very small stream of steam. I believe 90 or 100 gallons of tar will decarbonize 6 tons of coal if we can keep it going all the time. It is a matter of getting the tar to go all the time, where you get good results.

Mr. Schwarm—How long did you use tar?

Mr. Owens—About 4 months, I guess.

Mr. Schwarm—What effect did it have upon the benches?

Mr. Owens—None whatever on three, but it seemed to affect one, and I don't know whether I can lay it to the tar or not. It didn't hurt the bench; it never got around to the recuperators.

The President—Nobody else seems to have burned tar with the use of secondary air. This paper contemplates cutting out the arch and directing the flame up and making a plain setting out of it.

Mr. Owens—That was the same principle that I had; it went through those large openings in the arch.

The President—It went through the ordinary nozzles?

Mr. Owens—Went through the ordinary nozzles from the fire box and then we used my secondary air. My fire box was not over a cherry red. The heat went up through there and it went right underneath the fire box and extended up, so that it pointed towards the center of the arch and went in a kind of half-moon shape going in, and it all went up. There was no white heat in my fire box and in the arch.

The President—That seems to be different.

The Secretary—We burned tar in 2 benches for about 3 months with very good satisfaction. They were not exactly the type of bench that Mr. Whalen used his on, but they were a bridge wall setting, and we used our secondary air all of the time. We cut out all of our underdraft and had everything plugged up tight, and while it was considerably harder on the bench than a coal fire would be, the result was not very bad and they were in pretty good shape. We kept our heat very constant. We did not have any trouble in carbonizing fully as much tar, about 315 pounds in 4 hours in the retort, about the same as we are doing with coal. We took our tar from the hydraulic main into the separator, but found that was not quite sufficient for the tar we required. We erected a steam pump from the tar well and pumped a constant stream and let it overflow. This kept it stirred up in the separator and we used what was required from that, screening it through 2 or 3 screens. We tried several of those pipe burners, and one with fair success. They seemed to centralize the heat too much in one spot, and we finally went back to the old burner which my father designed some 15 or 20 years ago—longer than that—for burning oil. They used to burn crude oil in their benches. It consisted of 2 castings of conical shape and turned up on the points, so that the inner cone screwed up to the outer cone, leaving about ¼-inch aperture. This formed more of a whirling spray and seemed to spread the tar. We tried all the pipe burners which have been described in the journals, but none seemed to work so well as this old burner.

Mr. Whalen—The way I burned the tar, and I guess the most of us

we would get a white hot furnace and spray the tar in there, and the instant the tar got in there it exploded and gasified, and burned instantly, right at that point. It was a different way that Mr. Whalen burned it. It shot in this fire box with just enough heat to vaporize it, and the tar went through the fire arch in the form of vapor and a thick smudge, and the secondary air came over and burned that air and vapor, and it is the only proper way to burn tar because you can burn it in that way without any detriment to your bench.

The President—Through the use of secondary air.

Mr. Whalen—I found I had no trouble at all. I do not believe there is any particular damage done to the bench with tar. I believe it will make good bench fuel, if we can get some arrangement that will keep that thing going constantly all the time. I had no trouble keeping the heats up. I had no heat when it went through into the recuperators except when the burner was stopped up and turned on too much tar, and then we would throw it free. There would not be too much for the secondary to take care of, and it would not burn. I had one bench that I experimented upon, and worked on entirely for several days. I have decarbonized 13,000 pounds in 24 hours on that bench with 4 gallons per hour, and just about 100 pounds of fuel; but that was a case where I kept it constantly going all the time. On the other benches, where I didn't do so well, I took over 5 gallons per hour, but it wasn't able to keep the heats up—a waste of tar.

The President—That is a low quantity per ton.

Mr. Tippey—I have not had any experience recently with burning coal tar; but we had a relief holder partly filled up with water gas oil and tar mixture, and we burned that under our boilers. The relief holder tank was higher than the boilers, and fed the tar by gravity. This was used under horizontal tubular boilers, with latterly the grate bars within 6 or 8 inches of the bottom of the ash pit, and kept a coke fire on top of the grate, so that if for any reason the tar stopped coming for a minute it would be sure and light when it came again. I used the Snell burners most successfully. They were made in the city here; a brass burner and very good for burning tar. At the bridge wall, we we built two 4-inch walls, on each side of the bridge wall with a space of a foot between them, and that was built like checkerbrick in water gas works, so that the combustion would pass through the checkered brick in the first wall and whirl around in behind and strike against the solid face of the second wall and deflect and go through the opening. By that means, we were able to get smokeless combustion and had very good success, and only quit when the tar was all burned up.

The President—Mr. Blauvelt, haven't you some sort of spray burner in use down there, with liquid fuel?

Mr. Blauvelt—We experimented with the Parsons, and it worked very well. We did not have much trouble in plugging, but the great trouble was on account of the flame, which caused our firebrick to last only from 3 days to 3 weeks, and we had to give that up. Then we used the Snell burner in which the tar dribbles down, while the steam issues in and makes a diamond shape flow—it does not come in with the jet effect; and it saves the wear and tear on the furnaces, which is not more than coal fired boilers. We used to burn a good deal of tar that way, about 20 tons a day. We found a market for some of it. Instead of using gravity to get the tar through the burners, we used a system of compressed air. We handled most of the tar by compressed tar, rather than by pumping. A tank is filled and the air turned on and brought to the burner under pressure of 10 or 15 pounds to the inch.

Mr. Schwarm—I gain from the talk of the various members that the old theory about tar being destructive on the benches is not as much as we have been charging it with; is that your experience?

Mr. Barthold—The way I burned it, it is. The way Mr. Whalen burned it, I do not believe is as destructive. It seems to me in communities where we cannot sell our tar at a higher price than 2½ cents it would pay us to burn it according to your method. I feel this about the tar proposition, that the condition of the market is such that the more tar we burn or throw in the river the better. The residue would bring a better price, and it would be desirable from every point to burn it.

Mr. Whalen—I cannot figure how this gentleman thinks his tar worth 2½ cents a gallon to burn it. I would like to know how he figures it He said he can burn tar and obtain 2½ times better to burn it than sell it; I can't do that.

Mr. Schwarm—Those are not my figures here. Since this report was printed we have experimented further and got that consumption down quite a little lower, which makes it net about 2½ cents. We have experimented further, and it costs us about 2½ cents.

Mr. Sloan—We have experimented somewhat in Port Huron, and we did not succeed in preventing it from injuring the benches. I hope to experiment further with it. We injured our benches—that is, we experimented with old benches—some that we had to renew anyway in a very short time, and we used them up faster than if we had not put the tar in. We only renewed one, and it was only a matter of a few months time when we would have had to renew it anyway. We had to use an intense flame. We did not succeed in getting as low a figure to carbonize. The reports that we got from the works always showed they used a good deal more tar than our inventory showed at the end of the month, so our measurements may have been higher than they should have been.

The Secretary—I had a memorandum this morning which I omitted to read in regard to the death of L. E. Walker. Mr. Walker died in Lansing on May 4th, 1905, and as all of you, who are earlier members of the Association remember, he was very active in all of our meetings, and was President of the Association in 1900 and 1901. I think it is very proper that our Association should take some action. I move you, therefore, that the chair appoint a committee of three to draw up proper resolutions. (Motion carried.)

The President—With the permission of the meeting, I will name that committee later on, and have that resolution presented to-morrow. If there is nothing further to be brought up, a motion to adjourn until to-morrow morning at 10 o'clock will be in order.

Mr. Knight—It seems to me that the author of the paper on tar burning is entitled to a vote of thanks. I make a motion of that kind. (Motion carried.)

The President—We will stand adjourned to 10 o'clock to-morrow morning.

SECOND DAY—MORNING SESSION.

The President—Gentlemen, the first paper this morning is on

THE REMOVAL OF NAPHTHALINE FROM COAL GAS,

by Messrs. Alfred H. White and David H. Clary.[1]

The present paper is the fifth to be presented to your Association as the result of your support of a Fellowship in Gas Engineering at the University of Michigan. The study of the removal of naphthaline from coal gas commenced by the previous holder of the fellowship has been continued during the present year, and since the first of July has been carried on by Mr. J. M. Barnes, who holds the fellowship for the coming year. Some of the results of his tests are included in this paper. Our first paper[2] on the naphthaline problem, presented at your last annual meeting, was largely preliminary. Report was made of the analytic methods devised to allow the estimation of naphthaline in crude gas and tar, of the redetermination of the vapor tension of naphthaline and of experiments showing that neither water vapor, ammonia nor hydrocarbon gases exerted any unusual influence in varying the amount of naphthaline vapor which a gas could contain. Tests of the naphthaline removal in the condensing systems of four gas works were presented, but it was recognized that the methods of testing were still not completely enough developed, and that the data were not sufficiently numerous to warrant drawing positive conclusions.

The very great importance of tar as an instrument for removing naphthaline was however clearly indicated, it being shown that in two works practically the whole of the naphthaline was dissolved in particles of suspended tar by the time the gas had passed the primary condenser, and that complete separation of the tar at this point also meant almost complete removal of the naphthaline from the gas. In another works, however, tests at the same point showed a relatively large amount of naphthaline remaining as vapor in the gas after the tar was separated. Unfortunately no method was known which would allow us to determine the cause of the failure of this tar to dissolve out the naphthaline. It was, of course, possible that the tar was already saturated with naphthaline and incapable of absorbing more from the gas, but there was no way of determining it.

Absorbent Powers of Tar for Naphthaline at Different Temperatures.—We have since worked out a method given in Appendix III., which permits the determination of the maximum amount of naphthaline which a tar is capable of absorbing from a gas under given conditions. The solvent power of a number of tars and tar distillates for naphthaline has thus been determined at several temperatures, usually 77°, 95° or 113°, and 167° F. (25°, 35° or 45°, and 72° C.). The figures are given in Table I.

1. Holder of the Michigan Gas Association Fellowship in Gas Engineering at the University of Michigan.

2. The Removal of Naphthaline from Coal Gas, by Alfred H. White and S. Ball. Proceedings Twelfth Annual Meeting of the Michigan Gas Association, September, 1904.

TABLE I.—*Absorbent Capacity of Tars for Naphthaline at Different Temperatures.*

Location of Works.	Point of Sampling.	Date of Sampling.	Per Cent. Naphthaline in Original Samples.	100 Parts of Tar as Sampled Could Absorb the Following Additional Percentages of Naphthaline.				100 Parts of Saturated Tar Would Contain the Following Percentages of Naphthaline.			
				25° C. 77 F.°	35° C 95° F.	45° C. 113° F.	72° C. 161° F.	25° C. 77°.F.	35° C. 95° F.	45° C. 113° F.	72° C. 161° F.
Ann Arbor.....	Hydraulic.....	4-12-04	4.7	5.9	13.4	28.2	.....	10.0	16.0	25.6	.....
Grand Rapids...	Hydraulic.....	4-22-04	5 4	4 9	13.3	24.3	.....	9.8	16.5	23.9	.....
Jackson	Hydraulic.....	5-12-04	4 2	4.7	16.1	18.9	.....	8.5	17.5	19.4	.....
Battle Creek....	Hydraulic (tar seal).....	8-10-04	2.7	4.0	13.1	19.0	.....	6.4	14.0	18.2	.....
Battle Creek....	Hydraulic (water seal)	8-10-04	3.0	3.0	12.9	17.8	.....	5.8	14.1	17.7	.....
Saginaw.....	Hydraulic.....	2- 8 05	3.3	6.4	.....	23.1	85.0*	9.1	.....	21.4	47.7*
Grand Rapids...	Hydraulic.....	4- 4-05	4.8	3 2	.....	20.0	94.8*	7.7	.....	20.6	51.1*
Detroit.....	Hydraulic.....	5- 1-05	6.0	1.0	.....	14.3	73.4*	6.9	.....	17.7	45.7*
Average.....	Hydraulic.....	.....	4.8	4.7	13.7	23.6	84.4*	9.2	15.6	23.5	48.2*
Saginaw	Wells	2- 8-05	3.2	6.2	. .....	19.5	85.0*	8.8	.....	19.0	47.7*
Bay City.....	Wells.....	2-10-05	4.5	1.8	.....	9.9	90.4*	6.1	.....	13.1	49.9*
Grand Rapids...	P. & A. separator.....	4-22 04	7.9	2.9	15.0	21.9	.....	10.5	19.9	24.4	.....
Grand Rapids...	P. & A. separator.....	4- 4-05	9 6	3.8	.....	14.6	81.8*	12.9	.....	21.1	50.3*
Jackson	P. & A. separator.....	5-12-04	8.0	2.2	9.5	29.0	.....	10.0	16.0	28.7	.....
Ann Arbor	Tar washer.....	5-18 04	12.4	3.2	9.1	17.3	.....	15.1	19.7	25.3	.....
	Average of all samples.....	.....	5.7	3.8	12.6	19.8	85.1*	9.1	16.7	21.1	48.7*

* At the time when it is necessary to send this table to the printer, the tars at 72° C are still absorbing naphthaline. The figures given must therefore be considered simply as a minimum.

The results reveal that tars from various works possess different capacities for absorbing naphthaline under given conditions, a result not unexpected but never before proven. This knowledge enables us to answer in part at least one of the questions left unanswered in last year's paper. Of the works reported on last year, Ann Arbor and Grand Rapids were almost free from naphthaline trouble. Their tars show a naphthaline absorption value of 9.8 and 10 per cent. respectively at 77° F. Jackson had occasional touches of naphthaline trouble, and its hydraulic tar could only absorb 8.5 per cent. Battle Creek previous to the test had been having vexatious stoppages, and its hydraulic tar could only carry 6.4 per cent. naphthaline. It is evident, therefore, that the quality of the tar bears some relation to immunity from naphthaline stoppages. This is a slight gain in knowledge, but it leaves us blankly facing the larger question of the reasons for the differences in the quality of the tars. Considerable work has been done during the past year at the University of Michigan upon this point, both in small-scale distillations of coal in the laboratory and in experiments at various works. The results are, however, not conclusive, and no mention is made of them in this report, which only attempts to discuss the removal of naphthaline from the gas in the condensing and purifying systems of the gas works.

Returning to Table I. showing the absorbent power of various tars for naphthaline, very important information is to be gained by a study of the absorbent power of any one tar at the three different temperatures. While it has been heretofore recognized that large amounts of naphthaline were dissolved by the tar, the general impression has been that the naphthaline was separated out as the gas cooled and incidentally became dissolved in the tar present. As a necessary corollary it has also been the general opinion, even among advocates of the policy of scrubbing with tar to remove naphthaline, that the contact with cold tar was more efficient than with warm tar. Where warm tar has been used it has been with the idea of preventing loss in candle power of the gas, due to absorption of illuminants by the cold tar and not to any advantage in naphthaline removal.

Our figures, however, show the unexpected fact that the power of tar to dissolve naphthaline increases with the temperature. In all the fourteen tars tested, whether from hydraulic main, condenser or separator, there is no exception to this, and the average of all the results shows the following as the percentages of naphthaline in fully saturated tar:

Temperature.	Per Cent. Naphthaline.
25° C.= 77° F.	9.1
35° C.= 95° F.	16.7
45° C.=113° F.	21.1
72° C.=161° F.	48.7

It is not meant by this that in actual practice a tar would saturate itself to this limit. There will always be an equilibrium between the naphthaline dissolved in the tar and the naphthaline remaining as vapor in the gas which will prevent complete absorption of the naphthaline by the tar. The tar will absorb the first portions of the naphthaline very rapidly, and succeeding portions more and more slowly so that it would be impossible in actual gas works practice to allow time for a tar to absorb its maximum content of naphthaline from a gas at a given temperature.

It may be accepted, however, that tars can absorb more naphthaline and absorb it more rapidly at higher temperatures (up to at least 161° C.) than at lower temperatures. As a necessary corollary to this it follows that a tar saturated at a higher temperature will be supersaturated at a lower temperature. This excess of naphthaline may still be mechanically held by the tar, but the union will be no stronger than if it were mixed with the same amount of sand. As illustrations we present here several of our finished test bottles which after standing in the cooler laboratory with its changes of temperature have developed crystals of naphthaline adhering to the sides of the bottle. They are examples of how supersaturated tar may give rise to naphthaline deposits.

It is evident that if tar at 161° F. can hold more than five times the amount of naphthaline which it can at 77° that for purposes of naphthaline removal it is better to scrub the gas with hot tar. This is a rather revolutionary proposition and its acceptance would compel us to recast many of our usual theories of naphthaline removal and possibly to radically revise the practice of naphthaline removal as well. This theory of the powerful influence of hot tar affords the only satisfactory explanation of the enormous removal of naphthaline from the gas in the standpipe and hydraulic main. If we apply this theory in explanation of the removal of naphthaline in the gas works, we find that the tar vapors condensing into minute globules possess enormous surface so that the rate of absorption of naphthaline will be rapid. Further, at the higher temperatures of the standpipe the amount of naphthaline which the tar can hold is several times as large as when it leaves the condensers, so that the equilibrium between the naphthaline in vapor and naphthaline in tar at the higher temperatures will show a much larger proportion of naphthaline in the tar. Both these conditions will favor the rapid and almost complete removal of the naphthaline at the higher temperatures. It indicates that most of the naphthaline removal should be accomplished before the gas leaves the hydraulic main and suggests the possibility that if the amount of naphthaline is large that the tar may actually become supersaturated as it cools, and give back to the gas the naphthaline which it had previously removed at a higher temperature.

Another point is also indicated as to the interpretation of results of our tests made both last year and during the present year. In sampling from standpipes, hydraulic mains, etc., the gases are cooled down very materially as they pass through the glass tube filled with asbestos which filters out the tar. Wherever possible, these glass tubes were inserted inside the main to avoid cooling, but sometimes they had to be placed outside. In our preceding paper, we regretted that we could not estimate the influence exerted by this scrubbing of the gas with the cold tar. It is now evident that the influence of scrubbing with cold tar is relatively slight. If we tap a standpipe and pass the vapors through an asbestos filter which cools them and strains out the tar, it is unlikely that the tar will extract much more naphthaline from the gas in view of its greatly diminished solvent power for naphthaline at the lower temperature and its vastly decreased surface from that which it had when it existed as minute globules floating in the gas. The proportions of naphthaline found by analysis in the separated tar and in the gas should then give a fairly correct idea of the conditions actually existing in the pipe which had been tapped. This knowledge gives us much greater certainty in our interpretations of the results of tests.

Divisions of the Condensing System.—The condensing systems of

most gas works may be divided for the purposes of study into two divisions, one ending with P. & A. or other form of separator, and the other with the scrubber. In the first division the gas is gradually and quietly cooled in the hydraulic, foul main and primary condenser. In the tar separator and the exhauster the gas is violently agitated and forced through small openings and against walls everywhere dripping with tar. Emerging from this vigorous treatment it enters the second division of the condensing plant, being quietly and gradually cooled in the secondary condenser to be subjected again to vigorous agitation and scrubbing in some form of washer or scrubber, but this time in presence of a relatively large amount of water, which soon becomes ammoniacal.

Our study of naphthaline removal has been made at the terminal points of these divisions and therefore will be discussed with reference to conditions at:

1. The top of the standpipe.
2. The P. & A. tar separator.
3. The scrubbers.

Conditions at the Top of the Standpipes.—The details of the method of sampling are given in Appendix I. It is sufficient here to note that the gas was slowly drawn through a weighed glass tube containing asbestos to filter out the suspended tar and then through picric acid to take out the naphthaline vapor from the gas. The gas was collected in a ½ cubic foot aspirator at such a rate as to fill the aspirator in an hour. When an aspirator was full a fresh absorption train and aspirator was substituted for the previous one, so that an average result was obtained for each hour. In addition to these tests memoranda were made of kind of coal used, weight of charge and temperature of retort at time of drawing coke. The temperature was obtained by a Morse, or Holborn-Kurlbaum, optical pyrometer, modified slightly to suit our needs, which proved an easily portable and sufficiently accurate instrument. In this way data were collected in 5 works, 21 separate charges being tested in all. Unfortunately, not all of these tests are perfect, and although valuable corroborative testimony may be drawn from an incomplete test, it does not seem advisable to present such in detail. Two tests will be presented in full and the others summarized.

The most uniform series of results were obtained in Detroit, where on successive days simultaneous tests were made on a lower retort and the one above it in a bench of 8. Four results were thus obtained which are especially valuable because the retorts were charged by machinery, and thus probably more uniformly than would have been the case with hand charging. The temperatures were also all very close together, the maximum variations of retort temperature at time of drawing the charge being only 25°. These results are so nearly uniform that it is possible and advantageous to average them. The average result is given in Table II.

TABLE II.—*Data of Standpipe Tests at Detroit.*

Conditions of Tests.—Average of four similar tests on 2 retorts in a bench of 8, one retort being a bottom one and the other the one above it. Retorts 10 feet × 27 inches × 30 inches. Charge 460–500 pounds Youghiogheny coal charged by machine. Duration of heat 4½–5 hours. Temperature at time of drawing coke 925°–950° C. (1,700°–1,745° F.) Date of tests May 1 and 2, 1905.

Products per Cubic Foot of Gas in Each Hour.

(a) By weight in grams.

	Tar and Water.	Water.	Anhydrous Tar.	Naphthaline.			Free Carbon in Tar.
				In Gas.	In Tar.	Total.	
1st hour..	14 924	7.724	7.200	.0213	.4001	.4214	2.457
2d " ..	9.884	3.900	4.984	.0172	3766	.3938	1.944
3d " ..	5.020	1.616	3.404	.0154	.2449	.2603	1.578
4th " ..	2.312	.724	1.588	.0137	.1205	.1342	.769
Aver. per cubic ft...	8.035	3.741	4.294	.0169	.2855	.3024	1 687

(b) By percentage.

	Proportion of Tar for Each Hour.	Composition of Tar.		Composition of Anhydrous Tar.		Proportion of Naphthaline.	
		Water	Anhydrous Tar.	Naphthaline	Free Carbon.	Dissolved in Tar.	As Vapor in Gas.
	Per Cent.	Per Cent.	Per Cent	Pr. Ct.	Pr. Ct.	Per Cent.	Per Cent.
1st hour..	46.4	51.8	48.2	5.8	33 6	95.0	5.0
2d " ..	30.8	45 6	54.4	7.3	39.0	95 7	4.3
3d " ..	15.6	32.2	67 8	7.6	46.4	95.7	4.3
4th " ..	7.2	31.4	68 6	8.4	48 4	89.9	10.1
Aver. per cubic ft...	.....	46.5	53.5	6.6	39.3	94.5	5.5

Another complete and satisfactory test selected was made at Ann Arbor, where closely agreeing results were obtained on successive charges of the same retort. These tests are averaged in Table III.

TABLE III.—*Data of Standpipe Tests at Ann Arbor.*

Conditions of Test.—Average of two successive tests on one middle retort in a bench of 6. Retorts 9 feet × 16 inches × 28 inches. Charge about 285 pounds of Youghiogheny coal. Temperature at time of drawing coke 1,035° C. (1,895° F.).

Products per Cubic Foot of Gas in Each Hour.

(a) By weight in grams.

	Tar and Water.	Wate	nhydrous Tar.	Naphthaline.			Free Carbon in Tar.
				In Gas.	In Tar.	Total.	
1st hour..	22.341	9.299	13.042	.0124	.4144	.4268	4.263
2d " ..	6.951	2.436	4.515	.0078	.3162	.3240	1.365
3d " ..	3.106	.781	2.325	.0153	.2340	.2493	.804
4th " ..	.591	.057	.534	.0135	.0480	.0615	.348
Aver. per cubic ft...	8.247	3.143	5.104	.0122	.2531	.2653	1.695

(b) By percentage.

	Proportion of Tar for Each Hour.	Composition of Tar.		Composition of Anhydrous Tar.		Proportion of Naphthaline.	
		Water.	Anhydrous Tar.	Naphtha-line.	Free Carbon.	Dis-solved in Tar.	As Vapor in Gas.
1st hour..	67.7	41 6	58.4	3.2	32.6	97.1	2 9
2d " ..	21.0	35.1	64.9	7.0	30.2	97.6	2.4
3d " ..	9.4	25 2	74 8	10.0	34.6	93.7	6.1
4th " .	1.8	9.7	903.	9.0	65.1	78.1	21.9
Aver. per cubic ft...	.....	38.1	61.9	5.2	33.2	95.4	4.6

These tests are selected for presentation because they are the most complete and, so far as we know, are representative of the usual practice at these works. The conditions at the two works are widely different. Detroit has larger retorts and runs heavier charges for a longer time at lower heats. The coal of the two works is supposedly from the same district, but it would not be safe to assume that therefore it could be considered as identical. Each of the differences at the two works must exert its influence upon the nature of the products, and since the influence of each difference is almost entirely a matter of surmise, comparisons of the two works must be made cautiously. It is unfortunate that it was impossible to determine the amount and quality of gas during the tests or the rate at which it was evolved. Considering the difference in conditions at the two works, the average weights of products per cubic foot of gas on four hours' run are remarkably close together. The average amounts of tar, water, naphthaline and free carbon differ little in the two works. On comparing them hour by hour, the influence of the lighter charges and higher temperatures at Ann Arbor is shown by the larger proportion of tar the first hour. At Ann Arbor over two-thirds of the tarry products are evolved the first hour, while in Detroit less than half are. The proportions fall rapidly in the later hours so that in Ann Arbor less than 2 per cent. are evolved in the fourth hour, while at Detroit the amount is four times as great.

Further general discussion of these results might be interesting, but would almost necessarily be largely speculation. The subject involves the whole question of destructive distillation of coal, and it will require many more tests made under carefully regulated conditions before any attempt can justly be made to assign even an approximate value to the many variables in the problem. The particular problem under consideration in this paper is the removal, not the formation of naphthaline, and, fortunately, the data on this point are sufficiently concordant to allow us to generalize. Referring to these two tests and considering them hour by hour, it will be noted that the naphthaline is evolved continuously through the whole process of distillation. The largest amount is evolved during the first hour, and the decrease is continuous in succeeding hours. The amount is roughly in proportion to the amount of tar produced in the corresponding periods. In the first hour at Detroit the naphthaline amounted to about 6 per cent. of the anhydrous tar, and in the last hour to about 9 per cent., with a gradual increase in between. At Ann Arbor the difference was more marked, the increase being from 3½ per cent. the first hour to 11 per cent. the last.

More important than these figures, however, are those relating to the division of the naphthaline between the tar and the gas. It will be remembered that the method of sampling at the top of the standpipe

involves the filtration of the gas through asbestos to remove the mechanically suspended tar. Considered hour by hour, the results are concordant for the first three hours, the amount of naphthaline removed from the gas being close to 95 per cent. In the fourth hour at both works the percentage drops, but the absolute amount in the fourth hour is so small that it affects the average only slightly. At both Ann Arbor and Detroit the average during the four hours shows practically 95 per cent. of the naphthaline dissolved in and capable of being filtered out with the tar at the top of the standpipe. These conditions at Ann Arbor and Detroit are not exceptional. Experiments at other works have frequently shown as high a percentage. The lowest figure we have ever found is 81 per cent., and the average of all our tests shows 91 per cent. of the naphthaline held dissolved by the tar at the top of the standpipe. The average weight of naphthaline shown by our experiments is 349 milligrams per cubic foot of gas, and of this amount all but 31 milligrams are dissolved in the tar at this point. This seems a tremendous influence for the tar to exert in the few seconds while the gas is ascending the standpipe, but it must be remembered that the tar and naphthaline are formed simultaneously as vapors and condense together so that there is every opportunity for the tar to rapidly absorb a part of the large amount of naphthaline which our experiments indicate it can carry at the temperature of the top of the standpipe.

For our present purpose, the net results of our standpipe tests may be considered to be the knowledge that 90 *per cent. of the naphthaline is dissolved by the tar before the gas leaves the standpipe.* From this point to the tar separator the change is relatively slight. The gas remains in the hydraulic foul main and primary condenser much longer than in the standpipe, but owing to the lower solubility of naphthaline in tar as the temperature drops the removal of naphthaline is slower though still important. Our experiments show an average of eleven milligrams of naphthaline as vapor in the gas at the outlet of the primary condenser as compared with 31 at the top of the standpipe. This 11 milligrams of naphthaline still in the gas at the outlet of the primary condenser would be sufficient to saturate the gas at a temperature of 64° F. (18° C). The actual temperature at this point is usually above 100° F. (38° C.). At that temperature the gas could hold practically 7 times as much naphthaline as at 64° F., so that the gas leaves the condenser containing only a small proportion of the total amount of naphthaline which it could hold at that temperature. The highest percentage of saturation we have ever found at this point was 17.6 per cent. This effectually disposes of any lingering idea that it was the lowering in temperature which had thrown out the naphthaline, because in that case the gas must have been completely saturated when it left the condenser.

The P. & A. Tar Separator.—In most works the gas passes from the primary condenser to a tar separator usually of the Pelouze and Audouin type. We have made 9 tests in 7 different works to determine the effect of the P. & A. tar separator. The method of making the tests is given in detail in Appendix I., where also are to be found the detailed tables of the tests. A summary is given in Table IV.

which has increased from 58 to 79 per cent. in the 3 cases where this test was made. Eliminating this water and calculating to anhydrous tar, we find that the separator has taken out 73 per cent. of the anhydrous tar.

We would also expect a small change in the composition of the anhydrous tar. The theory of such a separator being that if a sudden change of direction be given by a baffle plate to a gas stream carrying particles of liquid, the greater momentum of the particles of liquid will carry them against the baffle plate, to which they will adhere, it is natural to expect the partial removal of the denser tars. An indication of such a change is found in the 3 tests which are complete enough to show it. Two were made at the Detroit works, but with an interval of 6 months between them, and both show an increase in the amount of naphthaline in the tar leaving the separator. In one case the increase is too small to be conclusive, but in the other the naphthaline in the anhydrous tar rises from 10.1 to 12.1 per cent., an increase altogether too high to be attributed to the few milligrams absorbed from the gas. In the Jackson tests there is also a similar though slight increase.

If the action of the separator is a purely mechanical one, it might be expected that the gas would emerge from the separator having just the same amount of naphthaline as when it entered. The emerging gas holds, however, less naphthaline in every case but two, and there the total amount present is so small as to make it difficult to estimate it correctly. The average amount of naphthaline per cubic foot of gas has fallen from 10.9 to 2.7 milligrams. The removal of naphthaline by the tar in the P. & A. must be laid to the agitation of the gases affording a better opportunity for the gases and the globules of tar to come in contact with one another. A parallel case may be found in another industry, in the manufacture of sulphuric acid, where it has long been known that the reaction between the gases and suspended liquids was accelerated by the mixing they got while passing from one chamber to another.

The amount of naphthaline remaining in the gas as it leaves the separator is so small that there is not a sample of gas from any works which we have tested which, had it been perfectly freed from tar, would not have stood cooling to 50° F. (10° C.) before it would have deposited naphthaline. Most of them could have been chilled to 40° F. (5° C.) before any deposit of naphthaline could form. In other words, if the P. & A. separator had removed absolutely all the tar, the gas would have passed through the works without a possibility of a stoppage and most of it would have stood the coldest winter weather with hardly an appreciable naphthaline deposit. While this beatific condition prevailed at the outlet of the P. & A., simultaneous tests of the gas passing out of the scrubbers in the same works often showed a dangerous amount of naphthaline in the gas and sometimes actual stoppages were being found within the works. To understand this anomalous state of affairs, it is necessary to study carefully the reactions taking place in the scrubbers.

The Scrubbers.—The purposes of the scrubbers are two-fold. In the first place, they are to remove all the fine particles of tar which escaped

TABLE IV.—*Summary of Tests at the Inlet and the Outlet of the P. & A. Tar Separator.*—(All weights are in grams per cubic foot of gas.)

Location of Works.	Temperature Degs F.		Weight of Tar and Water.		Weight of Anhydrous Tar.		Percentage Naphthaline in Anhydrous Tar.		Weight of Naphthaline.						Percentage of Naphthaline Saturation in Gas.		Temperature of Naphthaline Deposition Degs. F.	
									Total.		In Tar and Water.		In Gas.					
	In.	Out.	In.	Out.	In.	Out.	In.	Out.	In.	Out.	In.	Out.	In.	Out.	In.	Out.	In.	Out.
Battle Creek.....	108	72*	2.41	....	.95	....	8.6	....	.091	.005	.082	.004	.003	.001	2.5	8.4	43.	36.
Port Huron.....	136	130	4.12	2.28	...	..	...	....	.095	.012	.071	.007	.024	.005	6.1	1.9	76.	52.
Grand Rapids.....	96	106	1.58	....	.95	....	5.2	....	.060	....	.049	....	.011	.001	1.8	.4	64.	34.
Detroit, 11-'04.....	116	108	2.24	1.43	1.06	.32	13.0	13.3	.165	.051	.139	.043	.026	.008	17.6	6.7	79.	58.
Detroit, 5-'05	117	113	2.41	1.19	1.08	.36	10.1	12.1	.111	.043	.109	.043	.002	trace	1.4	0.	40.	0.
Ann Arbor, 7-'04	112	86	....	....	...	....	...	....	....	....	....	....	.015	.003	12.2	8.4	69.	45.
Ann Arbor, 8-'04 ...	110	90	2.77	.13	1.61	....	8.4	....	.140	.013	.136	.011	.004	.002	3.2	3.2	48.	37.
Ann Arbor, 7-'05	106	105	1.69	.63	.57	.06	10.4	....	.061	....	.059	....	.002	.002	1.9	1.9	37.	39.
Jackson, 8-'05.....	94	92	1.23	.39	.61	.04	8.7	9.0	.057	.006	.054	.004	.003	.003	5.1	4.8	44.	42.

*These samples were taken as near to the P. & A. as plugs could be found. In some cases the distance was enough to cause considerable drop in temperature between the "inlet" readings, and at Battle Creek the "outlet" tests are as far away as the outlet of the secondary condenser.

As indicated in the preceding section, there is only a comparatively small amount of naphthaline in the gas as it comes to the tar separator. The chief function of the tar separator is to separate a large portion of the mechanically suspended tar and water. The figures as to the per cent. of tar removed by the separator are not complete for all the plants, but the average of 5 tests shows 58 per cent. of tar removed. The tar emerging does not possess the same composition as that entering. The chief difference is in the percentage of water in the tar,

the P. & A. and did not separate of their own accord in the secondary condenser. It is almost necessary in order to accomplish this that the gas be scrubbed with some liquid. Water is universally used because it not only permits the effectual removal of the tar, but also in the same apparatus takes out the ammonia and part of the hydrogen sulphide. The form which the apparatus takes is entirely immaterial for our purpose. For our purpose the scrubbers are considered to commence as soon as the gas is brought into contact with the water.

We have a record of five tests in four different works in which results are given of the conditions at the inlet and outlet of the scrubbers. There are other partially incomplete tests which corroborate the evidence. These tests without exception show an increase in naphthaline as the gas passes through the scrubbers, an increase which in some cases is large enough to threaten trouble. The first thought is that gas has been picking up naphthaline deposited there at some previous period when the works were not running well. Such was our first impression, and it was only as instances increased and no exceptions were found that the conviction was forced upon us that there must be some systematic underlying cause to bring about this universal increase in the amount of naphthaline held by the gas as it leaves the scrubbers.

Since the synthesis of naphthaline in the scrubbers is out of the question, it follows that the napthaline must have been introduced from the only possible outside source—the tar carried in suspension by the gas. This tar, calculated to a water-free basis, has been found to contain as high as 25 per cent. naphthaline, which would mean that it is completely saturated. Its amount will vary with the equipment and policy of the works. One test at Ann Arbor showed only 45 milligrams of anhydrous tar per cubic foot of gas at the commencement of the scrubbing system (inlet of box washer), while a similar test at Detroit showed nearly four times as much. The Ann Arbor tar carried about 10 and the Detroit tar 26 per cent. naphthaline. The latter must have been fully saturated, nevertheless no appreciable amount of naphthaline was to be found in the gas at this point in either works.

Simultaneous tests at the outlet of the scrubbers showed a different state of affairs. At Ann Arbor the gas had picked up 2.5 milligrams naphthaline per cubic foot, an amount too small to give any trouble, for the gas would have had to be cooled to 42° F. (5° C.) before any naphthaline would have been chilled out. At Detroit, however, the gas had absorbed 9.5 milligrams, which would cause it to be saturated at 62° F. (17° C.). The outlet temperature was actually 73° F , so the gas was not entirely saturated, but there was also present suspended naphthaline removed by our asbestos filter to the extent of 8.6 milligrams per cubic foot. The time since the gas had come in contact with the naphthaline had evidently been too short to allow the gas to saturate itself. The total amount of naphthaline carried per cubic foot of gas was 18.1 milligrams, which would have been sufficient to saturate the gas at 72° F. (22° C.). The influence of the iron oxide purifier mentioned in our report a year ago was also evident here, the amount of naphthaline in the gas leaving the purifiers being only 5.6 milligrams, corresponding to a saturation temperature of 53° F. The Detroit test must have represented an abnormal condition in the works, for otherwise naphthaline stoppages would have been inevitable, and only trivial ones were being encountered.

A test at Port Huron gave similar results. There the gas entered the scrubbers with almost no naphthaline (saturation temperature 34° F.), and left them with a saturation temperature of 52° F., but carrying three times as much naphthaline in suspension as was contained in the vapor form. The total amount of naphthaline would have been sufficient to saturate the gas at 74° F. However, inasmuch as three-fourths of the naphthaline was in the solid form, it separated in the first dead space and formed deposits, giving rise to frequent stoppages between the scrubbers and purifier.

This explanation of the origin of solid naphthaline in the scrubbers accounts satisfactorily for the hitherto puzzling phenomenon of its appearance in and deposition from a gas which was not saturated with it. The mechanically suspended naphthaline is deposited at once in dead corners of the works, mains and purifying boxes, where, owing to the small circulation of gas, it remains even though the gas may be passing on only partly saturated. This was the case at Port Huron, where the stoppages were almost entirely confined to the scrubbers and the pipes between the scrubbers and purifiers. At no place in the works, however, was the gas over 50 per cent. saturated, so the phenomenon was for a time hard to explain.

Results of other tests at Grand Rapids and at Detroit, new plant and old plant, show an increase of naphthaline in the gas leaving the scrubbers. The amount of naphthaline is in some cases too small to cause trouble and under such circumstances is advantageous in increasing the candle power. A summary of these tests is given in Table V.

It is then evident that the gas takes up naphthaline from the tar in the scrubbers. The only possible explanation is that the tar has become supersaturated with naphthaline. There is usually no drop in temperature in the scrubbers sufficient to account for this, and agitation with water should cause no measurable change, although there is a slight theoretical one to be expected. The only other agent to be considered is the ammoniacal liquor. Should this dissolve out from the tar some constituent which is an especially good solvent for naphthaline, it might cause the remainder of the tar to become supersaturated and allow naphthaline to be set free. The phenols are such solvents of naphthaline. They are also acidic enough in nature to react with ammonia and form salts considerably more soluble in water than the phenols themselves. It is then a plausible hypothesis that the ammonia liquor might dissolve out phenols and cause the naphthaline previously dissolved in them to return to the free state. Proof that the ammonia liquor does dissolve phenols has been afforded by direct determination of the phenols in the ammoniacal liquor from the scrubbers at Ann Arbor and Detroit. The method is given in Appendix IV. Analysis shows that these ammoniacal liquors contain a little over $\frac{3}{4}$ of 1 per cent. of phenols, which correspond to about 40 milligrams of phenols to the cubic foot of gas. If these phenols should contain only 25 per cent. of their weight of naphthaline, it would be sufficient to saturate the gas at 62° F. It is probable that naphthaline would be thus liberated even from an unsaturated tar, for a tar when cold and already containing considerable naphthaline absorbs more very slowly. In the scrubbers the tendency would be for the separated naphthaline to rise to the top of the water and for the tar to sink to the bottom, thus effectually preventing their interaction. The only test which we have made of saturation of a tar washer was one from Ann Arbor, which contained 12.4 out of a possible 15.1 per cent. of naphthaline which it could hold at 77° F. There is no question but that in the case of a tar so fully saturated as that one, that further absorption of naphthaline would proceed at an extremely and, for our purpose, negligibly slow rate.

TABLE V.—*Summary of Tests on Naphthaline in Gas at Various Points of the Condensing System.*

	Naphthaline in Gas Mgms. per Cubic Foot.	Temperature of Naphthaline Depositions. Deg F.
Battle Creek; 8-9-04.		
(For further data see Appendix I., Table VI.)		
Primary condenser outlet	2 7	43
Secondary outlet	1.6	38
Holder outlet	11.2	65
Port Huron; 8-31-04.		
(For further data see Appendix I., Table VII)		
P. & A. inlet	23.5	77
Condenser inlet	5.1	52
Scrubber inlet	.8	34
Scrubber outlet	4.7	51
Detroit (new plant); 11-4-04.		
(For further data see Appendix I., Table VIII.)		
Primary condenser outlet.	26.3	79
Third condenser inlet	4.8	51
Rotary washer outlet	16.0	71
Purifier outlet	5.7	53
Detroit (new plant); 5-3-05.		
(For further data see Appendix I., Table IX.)		
Primary condenser outlet	2.2	42
Third condenser outlet	0.	0
Rotary washer outlet	9.5	62
Grand Rapids; 4-4-05.		
(For further data see Appendix I., Table X.)		
Primary condenser outlet	11.3	62
Washer cooler inlet	.5	32
Washer cooler outlet	1.1	35
Ann Arbor;		
6- 6-04. Primary condenser outlet	15.5	69
Secondary condenser inlet	3.2	45
7-22-04. Primary outlet	3.8	46
Secondary inlet	1.5	38
7- 8-05. Inlet P. & A.	1.5	38
Outlet P. & A.	2.0	40
7-12-05. Box washer inlet	0.	0
Rotary scrubber outlet	2.5	42
(For further data see Appendix I., Table XII)		

Summary of the Reactions in the Condensing System.—If we now turn from our consideration of the separate divisions of the condensing system and consider it as a whole, we find that in the hot standpipes and warm hydraulic and foul mains, the naphthaline is readily dissolved by the tar. Provided time enough is given in this stage of the process, the gas will come to the tar separator entirely free from any measurable amount of naphthaline other than that held dissolved by the suspended tar. The old practice of slow and gradual cooling was right, although based upon a misconception of its purpose. Viewed from the standpoint of naphthaline removal, the advantage of slow cooling is that it keeps the gas a longer time at a higher temperature and thus favors the solution of the naphthaline by the tar. A secondary advantage is that in slow cooling the particles of tar vapors separate as globules large enough to be more readily removed by the tar separator than the fine mist which would result from a rapid chilling of the gas.

Provided conditions for condensation have not been favorable in the foul main, the gas comes to the tar separator still containing naphthaline vapors. The tar separator by mechanical action removes most of the suspended tar. Through the agitation it gives the gas and the tarry surface it presents, it may also remove part of the naphthaline vapor from the gas. The suspended tar particles still continue their action on the naphthaline vapor in the following condensers, although the action is much slower as the tars are becoming nearly saturated at the lower temperatures.

The scrubbers by thorough churning with water remove the last of the suspended tar, as also the ammonia and some other constituents. But, unfortunately, the ammonia also dissolves phenols from the tar, thus liberating the naphthaline dissolved by them. If, as is apparently the case, the undissolved portion of the tar is already nearly saturated with naphthaline, this liberated from the phenols remains in the free state and, floating on the water of the scrubber, is taken up mechanically or as vapor by the gas. That mechanically suspended is partially stopped by the purifiers and also some of that held as vapor is apparently removed, although the capacity of the purifiers is limited in this regard, unless revivification by exposure to the air is frequent. This liberation of naphthaline by the ammonia in the scrubbers is apparently the most frequent source of naphthaline trouble.

Prevention of Naphthaline Stoppages.—From what precedes it is evident that there may be two causes of naphthaline deposits:

1. The tar is not dissolving all the naphthaline.
2. The tar is giving back part of the naphthaline already dissolved.

Trouble from the first cause will be lessened if the foul main be made large so that the gas will be kept hot until the tar has had time to remove the naphthaline. Whether or not this simple remedy would be sufficient in all cases cannot be told offhand. The hydraulic tars tested have never contained more than 25 per cent. of the maximum they could take up at 113° F. (45° C.), nor more than 10 per cent. as much as they could hold at 165° F. (72° C,), so that it seems reasonable tha with a sufficiently long contact at these temperatures the tar should be able to remove substantially all the naphthaline under all except very abnormal conditions. The tar might not be able to contain all the naphthaline, however. until it is cold, for although we have not met a hydraulic tar which was much over 50 per cent. saturated, even when cooled to as low as 77° F., we have found lighter separator tars 70 and 80 per cent. saturated at the same temperature. It is, therefore, possible that even with most careful treatment the tar might not always be able to dissolve all the naphthaline from the gas and retain it, but the probabilities are that in most cases it could do so.

Trouble from tar giving back naphthaline to the gas will evidently arise if the tar by cooling becomes supersaturated before it is separated from the gas. As mentioned previously, this is a case we have never met. The only trouble which we have met from this source has been in connection with the solvent action of ammonia in the scrubbers. If the tar is completely separated before the gas gets to the scrubbers, it is self evident that there can be no trouble from this source. The tar separator should, therefore, be set to remove the tar as completely as possible.

If there is naphthaline vapor in the gas after all the tar is separated, it is possible by chilling to throw it out and mechanically separate it, but the method is unsatisfactory. A more convenient method is the one, proposed in several modifications by different inventors, of scrubbing the gas with tar or tar distillates. From what has preceded it will be plain that so long as the tar or oil is not already nearly saturated with naphthaline the result can be readily achieved. Viewed merely from the standpoint of naphthaline removal and without any reference to effect on candle power, it is immaterial what particular distillate is used. Any one may be used, although some will be better than others. They will all work better and absorb more naphthaline when used warm than cold, but all will ultimately become saturated and require renewal. The oil scrubber should be the last in the series, as then it will only have to remove the naphthaline which has passed the fresh water scrubber, and will not be fouled by suspended tar.

APPENDIX I.

TABLE VI.—*Data of Tests on Condensing System of Battle Creek Gas Works.*—(All weights are in grams per cubic foot of gas.)

Point of Sampling.	Date 1904.	Temp. Degs. F.	Weight of Tar and Water.	Weight of Anhydrous Tar.	Percentage of Naphthaline in Anhydrous Tar.	Weight of Naphthaline.			Percentage of Naphthaline Saturation in Gas.	Temperature of Naphthaline Deposition. Deg. F.
						Total.	In Tar and Water.	In Gas.		
Hydraulic	8–9 A.M.	.....	4.40			.153	.099	.054	.....	93
Main	8–9 P.M.	.....	4.81			.114	.080	.034	.....	84
Tar seal	8–10 A.M.	.....	3.85	2.18	2.3	.103	.052	.051	.....	92
Hydraulic	8–9 A.M.	.....	2.66	1.13		.119	.087	.032	.....	83
Main	8–9 P.M.	.....	3.20	1.19	7.7	.108	.054	.054	.....	93
Water seal	8–10 A.M.	.....	2.88	1.08	4.5	.105	.051	.054	.....	93
Primary	8–8 P.M.	110	2.35	.57	4.7	.089	.084	.005	3.9	50
Condenser	8–9 A.M.	98	2.16	.57	14.7	.080	.076	.004	6.4	50
Outlet	8–9 P.M.	108	2.41	.59	13.3	.085	.082	.003	2.5	43
Secondary	8–9 P.M.	70	.42	.....	14.0	.009	.007	.002	13.5	40
Condenser	8–9 A.M.	70	.....	.....	.....	.005	.004	.001	8.4	36
Outlet	8— P.M.	72	.....	.....	.....	.006	.004	.002	9.2	38
	8–10 A.M.	72	.....	.....	.....	.....	.....	.005	28.3	51
Holder	.....	.....	.....	.....	.....	.....	.....			
Outlet	8–9–P.M.	.....	.....	.....	.....	.....	.....	.011	.....	65

Remarks.—In this works the gas goes through the primary condenser, exhauster, P. & A secondary condenser and two tower scrubbers.

TABLE VII.—*Data of Tests on Condensing System of Port Huron Gas Works.* (All weights are in grams per cubic foot of gas.)

Point of Sampling.	Date, 1904.	Temperature. Degs. F.	Weight of Tar and Water.	Weight of Naphthaline.			Percentage of Naphthaline Saturation of Gas.	Temperature of Naphthaline Deposition. Degs. F.
				Total.	In Separated Tar and Water.	In Gas.		
Hydraulic	3:30 P.M.	176	4.68	.077	.065	.012	... .	66
Main	8:30 P.M.	172	6.74	.109	.088	.021	.....	74
P. & A. Separator Inlet	8:31 A.M.	136	4.12	.094	.071	.023	6.9	76
Condenser	8:30 P.M.	128	1.59	.013	.006	.007	2.9	58
Inlet	8:31 A.M.	130	2.28	.013	.008	.005	1.9	52
Scrubber	8:30 P.M.	100	1.01	.031	.030	.001	1.3	34
Inlet	8:31 A.M.	94	.85	.046	.045	.001	1 4	34
Scrubber	8:31 A.M.	80	.19	.025	.020	.005	18.3*	52*
Outlet	8:31 A.M.	82	.06	.014	.009	.005	15.5*	51*
Purifier	8:31 P.M.	80	.13	.018	.014	.004	15.0*	49*
Inlet	8:31 P.M.	80	.24	.021	.015	.006	20.5*	53*
Purifier	8:31 P.M.	80	.....	.005	.....	.005	20.1	53
Outlet	8:31 P.M.	80	.....	.002	.....	.002	8.4	41

*At the scrubber inlet and beyond, tar was practically absent, the naphthaline under the heading, "In Separated Tar and Water," being mostly in the free crystalline state. If the total naphthaline be considered to be in a state where it could have been absorbed by the gas, and had it passed completely into the vapor state it would have saturated the gas at 72° F. As it was, it separated out in part, forming deposits between the scrubber and purifier.

Remarks.—In this works the gas goes from a rather long foul main to the exhauster and the P & A. tar separator, then to the condenser and scrubber.

TABLE VIII.—*Data of Tests on Condensing System of Detroit Gas Works.—Station A.—New Plant.*

(All weights are in grams per cubic foot of gas.)

Point of Sampling.	Date, 1904.	Temperature Degs. F.	Weight of Tar and Water.	Weight of Anhydrous Tar.	Percentage Naphthaline in Anhydrous Tar.	Weight of Naphthaline, Total.	Weight of Naphthaline, In Tar and Water.	Weight of Naphthaline, In Gas.	Percentage of Naphthaline Saturation in Gas.	Temperature of Naphthaline Deposition Degs. F.
Standpipe	11–4 A.M.	302	8.98	5.27	5.9	.338	.313	.025	....	78
	11–4 A.M.	320	7.73	....	....	.316	.273	.043	....	88
1st Condenser	11–3 A.M.	120	2.37	1.06	13.7	.172	.145	.027	15.0	80
Outlet	11–4 A.M.	112	2.12	1.06	12.4	.158	.132	.026	20.0	79
2d Condenser	11–3 P.M.	115	1.80	.38	12.4	.057	.047	.010	6.9	63
Inlet	11–4 A.M.	102	1.06	.25	15 2	.043	.038	.005	6.5	53
3d Condenser	11–3 P.M.	90	....	....	....	.074	.069	.005	10.2	51
Inlet	11–4 A.M.	84	1.03	.39	16.6	.074	.065	.005	13.8	51
Box washer	11–4 P.M.	76	....	....	....	....	....	.010	46.4	63
Inlet	11–5 A.M.	76	..	....	....	....	....	.015	65.9	69
Rotary washer	11–4 P.M.	60	....	....	....	....	....	.016	supersaturated	71
Outlet	11–5 A.M.	60	....	....	....	....	....	.018	supersaturated	72
Purifier	11–5 A.M.	60	....	....	....	....	....	.006	67.8	53
Outlet	–A.M.	...	....	....	....	....	....	....	....	..

Remarks—In this works the gas goes through a primary condenser, exhauster, P. & A. tar separator, second and third condensers, box washer and rotary washer.

TABLE IX.—*Data of Tests on Condensing System of Detroit Gas Works.—Station A.—New Plant.*

(All weights are in grams per cubic foot of gas.)

Point of Sampling.	Date, 1905.	Temperature. Degs. F.	Weight of Tar and Water.	Weight of Anhydrous Tar.	Percentage Naphthaline in Anhydrous Tar.	Weight of Naphthaline. Total.	Weight of Naphthaline. In Tar and Water.	Weight of Naphthaline. In Gas.	Percentage of Naphthaline Saturation in Gas, Per Cent.	Temperature of Naphthaline Deposition. Degs. F.
1st Condenser	5–3 A.M.	120	2.42	1.09	10.4	.117	.114	.003	1.6	
Outlet	5–3 P.M.	114	2.40	1.08	9.6	.106	.104	.002	1.2	44
2d Condenser	5–3 A.M.	116	1.25	.34	13.5	.046	.046	trace	.0	40
Inlet	5–3 P.M.	110	1.13	.36	11.4	.041	.041	trace	.0	0
3d Condenser	5–3 A.M.	90	.46	.11	24.5	.028	.028	trace	...	0
Inlet	5–3 P.M.	86	.36	....	....	....	....	trace	.0	..
Box washer	5–3 A.M.	72	.28	.16	26.7	.043	.043	trace	.0	0
Inlet	5–3 P.M.	71	....	....	....	.020	.020	trace	.0	0
Rotary washer	5–3 A.M.	72	.04	....	....	.017	.008	.009	53.0	61*
Outlet	5–3 P.M.	74	.06	.01	100.	.020	.010	.010	49.7	63
Purifier	5–2 P.M.	104	....	....	....	....	....	.006	6.1	53
Outlet	5–2 P.M.	104	....	....	....	....	....	.006	6.3	53

*At the rotary washer outlet, tar was practically absent, the naphthaline under the heading, "in tar and water," being mostly in the free crystalline state and visible as such. If the "total naphthaline" be considered to be in a state where it could have been absorbed by the gas, and had it passed completely into the vapor state, it would have saturated the gas at an average of 38° F. instead of 62°.

TABLE X.—*Data of Tests on Condensing System of Grand Rapids Gas Works.* (All weights are in grams per cubic foot of gas.)

Point of Sampling.	Date, 1906.	Temp. Degs. F.	Weight of Naphthaline in Gas.	Percentage of Naphthaline Saturation of Gas.	Temperature of Naphthaline Deposition. Degs. F.
Primary	4–4 A.M.	96	.016	2.6	71
Condenser	4–4 P.M.	97	.007	1 0	56
Outlet					
Washer cooler	4–4 A.M.	110	.001	.8	54
Inlat	4–4 P.M.	103	trace	.0	0
Washer cooler	4–4 A.M.	74	.002	7.9	37
Inlet to	4–4 P.M.	75	.003	12.1	42
Last section					
Washer cooler	4–4 A.M.	72	.002	10.4	38
Outlet	4–4 P.M.	70	.001	2.6	32
Holder	4–5 A.M.	65	.011	100.	65
Inlet	4–5 A.M.	65	.013	supersaturated	68

Remarks—In this works the gas goes from the primary condenser through the exhauster to the P. & A. separator, then to the washer-cooler (a combined condenser and scrubber), and then to the purifiers.

TABLE XI.—*Data of Tests on Condensing System of Detroit Gas Works, Station A, Old Plant.* (All weights are in grams per cubic foot of gas.)

Point of Sampling.	Date, 1901.	Temperature, Deg. F.	Weight of Tar and Water.	Weight of Tar in Naphthaline. Total.	Weight of Tar in Naphthaline. In Tar and Water	Weight of Tar in Naphthaline. In Gas	Percentage of Naphthaline Saturation of Gas.	Temp. of Naphthaline Deposition. Degs. F.
Standpipe	11 9 A.M.	130	9 88	.287	.283	.004	1.5	48
	11–9 A.M.	140	4.88	.150	.146	.004	1.0	48
Condenser	11–9 A.M.	104	1.30	.072	.060	.012	13.3	66
Inlet	11–9 P.M.	110	.94	.048	.045	.003	2.3	43
Condenser	11–9 A.M.	72		.020	.018	.002	11.5	40
Outlet	11–9 P.M.	70		.033	.032	.001	9.7	37
Rotary scrubber	11–10 A.M.	65				.005	40.5	50
Outlet	11–10 A.M.	65				.006	49.1	53

Remarks.—In this works the gas goes from the hydraulic main to the exhauster, then through a tar washer to condensers, then to rotary washers and purifiers.

TABLE XII.—*Data of Tests on Condensing System of Ann Arbor Gas Works.*—(All weights are in grams per cubic foot of gas.)

Point of Sampling.	Date, 1904.	Temperature Degs. F.	Weight of Tar and Water.	Weight of Anhydrous Tar.	Percentage Naphthaline in Anhydrous Tar.	Weight of Naphthaline. Total.	Weight of Naphthaline. In Tar and Water.	Weight of Naphthaline. In Gas.	Percentage of Naphthaline Saturation of Gas. Per Cent.	Temperature of Naphthaline Deposition Degs F.
Inlet	7–13 P.M.	106	1.709	.629	9.9	.064	.062	.002	2.2	39
P. & A.	7–14 A.M.	107	1.676	.513	10.9	.057	.056	.001	1 1	34
Outlet	7–13 P.M.	105	.048	.043	.....	.002	trace	.002	2.3	39
P. & A.	7–14 A.M.	105	.592	.065	1.6	.003	.001	.002	2.3	39
Inlet	7– 7 A.M.	86	.196	.038	2.6	.004	.001	.003	8.0	44
Box washer	7– 8 P.M.	87	.246	.057	3.5	.004	.002	.002	5.1	39
Outlet	7– 7 A.M.	88	.051	.049	.....	.....	trace	trace	0.0	0
Rotary	7– 8 P.M.	90	?	?	.....	.....	trace	trace	0.0	0

Remarks.—In this works the gas goes from the primary condenser through the exhauster to the P. & A., then to the secondary condenser, tar washer and rotary scrubber.

TABLE XIII.—*Data of Tests on Condensing System of Jackson Gas Works.*—(All weights are in grams per cubic foot of gas.)

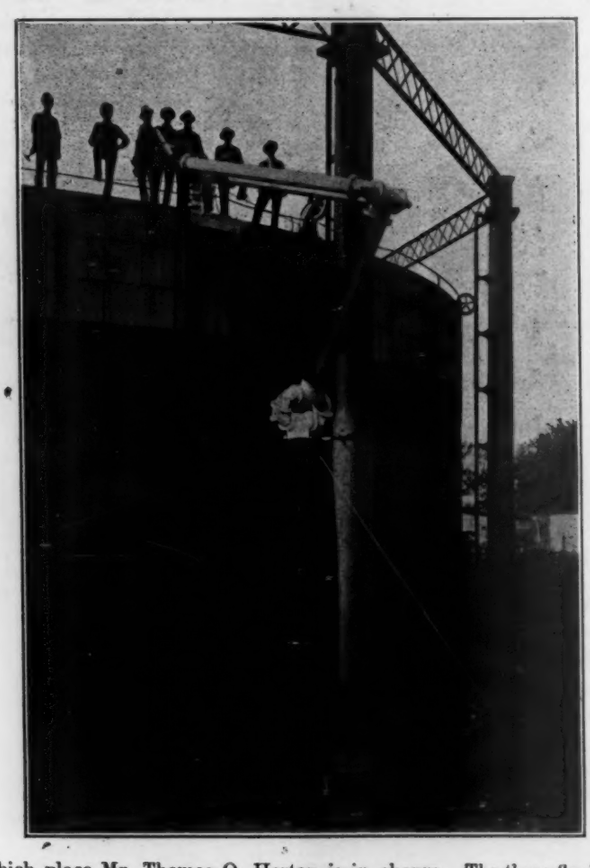
Point of Sampling.	Date, 1905.	Temperature Degs. F.	Weight of Tar and Water	Weight of Anhydrous Tar.	Percentage Naphthaline in Anhydrous Tar.	Weight of Naphthaline.			Percentage of Naphthaline Saturation in Gas.	Temperature of Naphthaline Deposition Degs. F.
						Total.	In Tar and Water.	In Gas.		
P. & A. Separator	8–17 P.M.	92	1.02	.56	7.8	.045	.043	.002	3.9	40
Inlet	8–18 A.M.	96	1.44	.67	9 6	.068	.064	.004	6.4	48
P. & A. Separator	8–17 P.M.	90	.28	.04	10 5	.006	.004	.002	4 2	40
Outlet	8–18 A.M.	94	.50	.04	7.5	.006	.003	.003	5.3	44
1st Scrubber	8–17 P.M.	86	.23	.03	29.7	.018	.008	.010	25.7	63
Inlet	8–18 A.M.	87	.26	.02	30.4	.012	.007	.005	12.2	52
2d Scrubber	8–17 P.M.	74	.06	.02	42.8	.022	.009	.013	64.0	67
Outlet	8–18 A.M.	73	.04	.01	?	.019	.009	.010	53.1	63
Purifier	8–17 P M.	74	.18	.07*	9.0*	.013	.006	.007	34.5	57
Outlet	8–18 A M.	74	.19	.07*	5.8*	.009	.004	.005	24.6	52

*The "Anhydrous tar" in this case possibly includes a considerable amount of dust from the purifiers which were under an unusually high pressure.
Remarks.—In this works the gas passes from the primary condenser through the exhauster P. & A., secondary condenser, and two tower scrubbers.

(To be Continued.)

Flexible Outside Holder Piping.

It frequently happens that it is desirable to increase the size of holder pipes, and excavation either under a brick or steel tank is not only an expensive and dangerous method, but one that requires more time for the installation than can often be afforded. In King's Treatise, Vol. 2, p. 195, is shown a flexible outside standpipe of which design there are 3 examples in this country. The first was at Danbury, Conn., installed by Prof. Edgerton, one at Staten Island, of 12-inch cast iron pipe, and one at New Orleans, of 24-inch × 30-inch steel pipe. The latter two were installed by Mr. Fred. H. Shelton. We herewith reproduce a photograph taken of the installation made at Clifton, Staten Island, at

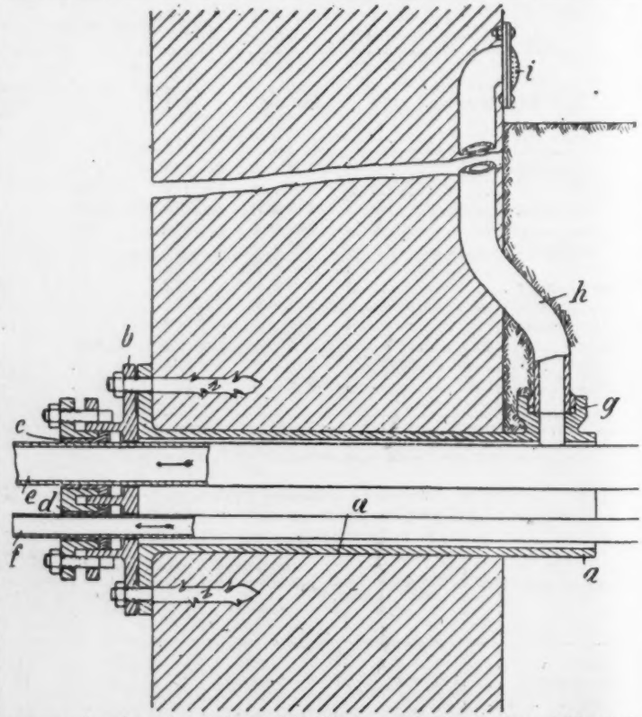


which place Mr. Thomas O. Horton is in charge. The three flexible joints shown are made by the flanges of the elbows and tees being tongued and grooved and held together by bolts passing through the tees and through the elbows at the point where ordinarily cleaning holes are provided.

The first installation was made at Ivry, France, some 60 years ago. We are informed that no naphthaline trouble has ever been experienced with this method of articulated outside piping.

Another German Invention.

The object of the invention herewith described, which was made the subject of German Letters Patent, but so far as can be ascertained at this time the device has not been patented in this country, is to provide means to prevent gas or water coming from broken pipes to enter adjoining houses. It has been found that often the openings made for the admission of gas and water services to buildings are not made with sufficient care, so that the walls do not closely embrace said pipe, thereby making it easy for gas or water, in case of a break outside of a house, to enter the building, often causing damage and not infrequently dangerous explosions. This is especially the case when hard, frozen ground prevents the escape from a leak in other directions. This device not only makes such an occurrence impossible, but also affords



means whereby a break is readily discovered and on the outside of the premises affected. In the cellar wall of the building is inserted a cast iron pipe *a* of sufficient capacity. This is closely walled in and anchored, as shown in the illustration. The pipe is open toward the outside, but closed tightly on the inside of the building by means of the cover *b*. The cover contains stuffing boxes *c* and *d*, for passage of the gas and water services *e* and *f*. On the pipe *a* there is a hub *g*, which is on the outside end of said pipe. Into this pipe *h* is secured, which is turned back and protected by the wall and carried upward so that the end is well above the adjoining ground. The opening is turned outward and protected with a screen *i*, as shown. If a break does occur, the operation is obvious, since either water or gas would soon be detected if flowing from the opening just mentioned.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

MR. A. B. SLATER, who resigned some weeks ago from the engineering staff of the Western Gas Construction Company, of Fort Wayne, Ind., sailed for South America early this month. He will remain abroad for a few months, and shortly after his return will start for the Far East, spending considerable time in India. During the latter trip he will represent the Western Gas Construction Company. Just prior to his leaving Fort Wayne he acted as a host at a dinner party of nine, which included the heads of departments of the Western Gas Construction Company and Messrs. S. M. Foster and Charles McCulloch, covers for which were laid in the dining hall of the Wayne Club. With the inner man well served, Mr. Olaf N. Guldlin, President of the Construc-

tion Company, assumed the duties of toastmaster, and the burden of the speeches was goodwill for the Company and good luck to Mr. Slater wherever his journeyings might lead him. The feature of the happening, however, was the presentation to Mr. Slater, on behalf of the Advisory Board of the Company, of a beautiful chiming watch, as a token of his associates respecting their appreciation of his merit and worth as a man and of his skill as an engineer. The presentation speech was very happily made by Mr. Theodore Scheuman.

Some days ago an attempt was made by burglars to blow open the safe of the Cruse-Kemper Company, in its works' office at Ambler, Pa. The attempt failed, and the miscreants made good their escape, taking with them the money and timepiece of the watchman, William Sweeney, whom they had severely wounded and subsequently bound and gagged.

On the 10th inst., Mr. Paul Doty, Vice-President and General Manager of the St. Paul (Minn.) Gas Light Company, associated with Messrs George H. Prince, of St. Paul, and J. W. Smith, of Fargo, completed the purchase from Messrs. Sinclair Mainland and William Mainland, of Oshkosh, Wis , of all the rights and properties of the Union Light Heat and Power Company, of Fargo, N. Dak. The officers elected were: President, Paul Doty; Vice-President, J. W. Smith; Secretary, O. G. Barnes; Treasurer, J. W. Smith. General Manager Markhus will remain in active charge of the Company's trading. That Mr. Doty and his associates will be successful in their delevopment of the lighting business at Fargo is a certainty; but here's wishing them good luck just the same. As a testimony to the way the Messrs. Mainland have of doing things, it may be remarked that the Fargo gas and electric plants are in first-class condition.

The Brooklyn Borough Gas Company, of Coney Island, N. Y., is in the market for a gasholder.

The Laclede Firebrick Manufacturing Company, has issued a very handsomely illustrated little booklet which also gives sizes of standard shapes, with cuts of each design.

Mr. J. Armitage Drake, Managing Director of the well-known gas apparatus manufacturing concern known as Drake's Limited, of Halifax, England, arrived in New York, per steamship Campania, the 14th inst. He is accompanied by his wife. It was his intention to attend the Milwaukee meeting of the American Gas Light Association, but pressing engagements in the East obliged him to forego the trip.

The Chicago police records for the 13th inst., show that on the date named a thief named "Tony" Gaughan was overcome by gas in the basement of 2119 Archer avenue while attempting to break into the money box of a prepayment meter. In his haste he cut a hole in the outlet pipe and the escaping gas prostrated him. He was dead when discovered.

The following from a recent issue of the Lancaster, Pa., *Daily Intelligencer*, is referred to the legislative creation that has been endeavoring to "suppress" gas pressures in New York: "One theory to explain those mysterious variations in the family gas bills, with which all payers of such accounts are familiar, is given by a man who says he knows. According to this explanation, the gas flowing into the house is registered by the meter at the point of entrance, but the meter will not register the other way, and when gas flows out again from the house pipes into the main, as it can do with perfect ease, there is no reduction in the meter's reading. Under these conditions, when the pressure in the main is raised more gas is forced into the pipes, and when the pressure is decreased it flows out again. There are several hundred feet of piping throughout an average house, and the total volume of space admits of considerable compression, quite enough to make an appreciable difference between the gas used and that registered."

It is reported that the Cedar Rapids Gas Company, will extend their mains from that city through Kenwood Park to Marion, Ia.

Norfolk, Va , gas consumers want bills left with them when meters are read. As it will serve no useful purpose, the Manager, E. C. Hathaway, has discountenanced this practice.

The city of Cedar Rapids, Ia., wants to install a "testing machine" and thinks it can get what it wants for about $50. It should read the following from the Los Angeles *Express*: "City gas meter Inspector Jordon is ready for business—if some one will only make a request for his services. He waited 3 months to secure $700 worth of apparatus, the city paying him for doing the ordering and waiting, a salary of $125 a month. Now that he has his equipment, he is patiently waiting for the opportunity to use it. The city charges $1 for the inspection of each meter. Jordon believes gas meter owners have come to the conclusion that 'where ignorance is bliss, 'tis folly to be wise.' There is a great deal more pleasure to be obtained from complaining against the gas robbing gas companies than to have an investigation and perhaps find that the meter is running more slowly than it should register. The dollar fee has knocked the inspection business into a cocked hat. Jordon says that he had one or two requests for inspections, but he was not really sure about this. By the provisions of the ordinance he is required to turn over his collections to the city clerk, who shall place them to the credit of the gas meter testing fund. At the present time the account shows a large deficit and no assets. His receipts are nil. The office is supposed to be self-supporting."

The Winnipeg (Man.) Gas Company makes the following prices. Lighting gas, $1.50 per 1,000 cubic feet, with a discount of 10 per cent. on payment within 10 days from date of bill. Fuel gas, $1.50 per 1,000 cubic feet, with a discount of 20 per cent. This will mean $1 35 net for lighting and $1.20 net for fuel gas to the consumer. The old rate for both lighting and fuel gas was $2 per 1,000 cubic feet with a discount of 15 per cent. for lighting gas, and the following monthly discounts for fuel gas: Up to 2,000 feet, 20 per cent., up to 4,000 feet 25 per cent , over 4,000 feet, 30 per cent.

Among the incorporations at Albany, N. Y., appears the following: Goshen Illuminating Company, Orange county, (gas) capital $25,000 and directors: James Gamble, W. H. Dickson, New York, J. B. Johnston, Brooklyn.

There is a well defined rumor current to the effect that the two gas companies at Spokane, Wash., will merge and it is said that the new merger will be known as the Union Gas Company. The new plant will, when completed, cost about $250,000. It is on the south side of the river in Dennis and Bradley's addition.

A deal has been made whereby the electric light company of Charles City, Ia., passes from H. V. Fussel and others to F. O. Martin of Floyd, and A. L. Dodd of this city. This last named gentlemen recently purchased the water power at Floyd and will use it to furnish power for the light plant of this city, transmitting the electricity some 6 miles by means of a feed wire. It is said the new company will also make many improvements, putting in a new dam and eventually erecting a large gas and heating plant to supply heat and gas for cooking purposes.

The tar plant of the Racine (Wis.) Gas Light Company, was damaged $2,000 by fire some days ago.

The New London Gas and Electric Company has formulated plans for the enlargement of its gas branch. The tank will more than double its present capacity. The boiler shop will be enlarged and an addition will be made to the rear of the main building. A frame building for storage purposes will also be constructed.

The Council granted a franchise to Clay and Washburn for the erection of a gas plant in Montrose and also for the laying of mains within the town limits. These gentlemen will begin within 6 months the construction of a gas plant to supply light and heat to the citizens of Montrose. The estimated cost of the plant is $20,000. The gentlemen named are prominent physicians of the city and represent outside capital.

Extensions to the system of mains of the Nashville (Tenn.) Gas Company are being made which will cost about $28,000. By the conclusion of the present year there will have been put down during the year about 16 miles of new gas mains.

The bitter fight at Lowell, Mass., for the street lighting is now ended and the Lowell Gas Light Company has been awarded the street lighting contract at $22 75 per lamp, $5.75 per lamp less than the contract which expired on September 15, and Mayor Casey signed the contract. The Welsbach lamps will continue in use so that there will be no change in lamps. The new contract means a saving to the city of $34,000 over the old contract. Besides this big saving the Company, under the new contract, will give an all night and every night schedule.

THE AMERICAN GAS LIGHT JOURNAL

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PROPRIETORS.

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NOTIFICATION RESPECTING ADVERTISING.

Orders for new advertising, or for changes in standing advertisements, to insure attention in the issue following their reception, must be in hand any time of Wednesday.

MONDAY, OCTOBER 23, 1905.

The Market for Gas Securities.

There is no other fact of the business situation which is so vital as that of the prevailing confidence. The maladministration that has been revealed in our iusurance companies has not caused the slightest business weakness as a result of the disclosures. The financial situation is so strong that it is unshaken by them and the strength of the structure is confidence. Money has ruled easier for the past week. The prices of gas stocks and bonds show few changes from last week, The regular quarterly dividend of 2½ per cent. on the shares of the Municipal Gas Company, of Albany, N. Y., is payable the 1st prox.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.
16 WALL STREET, NEW YORK CITY.
OCTOBER 23.

☞ All communications will receive particular attention.
☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	Capital.	Par.	Bid.	Asked.
Consolidated. ...	$73,177,000	100	186½	187
Central Union, Bonds, 5's .	3,000,000	1,000	108	110
Equitable Bonds, 6's.	1,000,000	1,000	..	102
" 1st Con. 5's.	2,300,000	1 000	118	120
Mutual	3,500,000	100	275	290
Municipal Bonds.	750,000	..	..	..
New Amsterdam Gas Co..				
Bonds, 5's	11,000,000	1,000	111	114
New York & Richmond Gas Co. (Staten Island).	1,500,000	100	37	43
1st Mtg. Gold Bds. 5 p. ct.	1,000,000	..	98	104
Northern Union, Bonds, 5's.	1,250,000	1,000	105	107
New York and East River..				
Bonds 1st 5's.	3,500,000	1,000	112	114
" 1st Con. 5's.	1,500,000	..	106½	108½
Standard.	5,000,000	100	140	160
Preferred.	5,000,000	100	155	175
Bonds, 1st Mortgage, 5's	1,500,000	1,000	111	114
Yonkers	299,650	500	130	..
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	180	190
" " Bonds (5's)	15 000,000	1,000	113	115
Bay State.	50,000,000	50	3/16	¼
" ncome Bonds.	2,000,000	1,000	..	75
Binghamton Gas Works.	450,000	100	..	65
" 1st Mtg. 5's.	500,000	1,000	95	100
Boston United Gas Co.—				
1st Series S. F. Trust.	7,000,000	1,000	82	85
2d " " " .	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	10	12
" " Bonds, 5's	5,250,000	1,000	75	80
Capital, Sacramento.	500,000	50	..	35
Bonds (6's).	150,000	1,000	..	..
Chicago Gas Co. Guaranteed Gold Bonds.	7,650,000	1,000	104	104¼
Cincinnati Gas and Electric Co	29,500,000	100	106	501½
Columbus (O.) Gas Co., 1st Mortgage Bonds.	1,500,000	1,000	90	..
Columbus (O.) Gas Lt. & Heating Co.	1,682,750	100	..	95
Preferred.	3,026,500	100	107¼	108
Consumers, Toronto.	,000,000	50	200	204
Consolidated, Baltimore.	11,000,000	100	86¼	87
Mortgage, 6's.	3,600,000	..	..	118
Chesapeake, 1st 6's.	1,000,000	..	..	..
Equitable, 1st 6's.	910,000	..	..	..
Consolidated, 1st 5's.	1,490 000	..	..	112
Consolidated Gas Co. of N. J.	1,000,000	100	15	17
" Con. Mtg. 5's.	880,000	1,000	92	95
Bonds	75,000	..	..	100
Detroit City Gas Co.	4,825,500	50	..	50
" Prior Lien 5's.	5,603,000	1,000	..	98
Detroit Gas Co., 5's.	281,000	1,000	75	80
" Inc. 5's.	16,000	100	98½	100
Equitable Gas & Fuel Co., Chicago, Bonds.	2,000,000	1,000	..	101
Essex and Hudson Gas Co.	6,500,000	..	39	40
For Wayne	2,000,000	..	..	..
" Bonds.	2,000,000	..	55	..
Grand Rapids Gas Lt. Co. 1st Mtg. 5's.	1,225,000	1,000	104½	105
Hartford	750,000	25	190	200
Hudson County Gas Co., of New Jersey.	10,500,000	..	110	112
" Bonds, 5's.	10,500,000	..	110	110½
Indianapolis.	2,000,000	..	60	70
" Bonds, 5's.	2,650,000	..	104½	105
Jackson Gas Co.	250,000	50	82	..
" 1st Mtg. 5's.	290,000	1,000	97	100
Kansas City Gas Light Co., of Missouri.	5,000,000	100	..	36
Bonds, 1st 5's.	3,822,000	1,000	102	104
Laclede, St. Louis	10,000,000	100	.	
Preferred.	2,500,000	100	95	110
Bonds	10,000,000	1,000	108½	109
Lafayette Gas Co., Ind.	1,000,000	100	..	60
Bonds	1 000,004	1,000	60	65
Louisville.	5,570,300	50	143	145
Madison Gas & Elec. Co.				
" 1st Mtg. 6's.	350,000	1,000	106	108¾
" 6 per cent. scrip, due 1910.	100,000	25	85	87
Montreal, Canada	2,000,000	100	218	218¾
Nashville Gas Lt. Co.	1,000,000	100	110	..
Newark, N. J., Con. Gas Co.	6,000,000	..	56	58
Bonds, 6's	4,600,000	..	137	138
New Haven.	2,000,000	25	200	..
Peoples G. L. & Coke Co., of Chicago.	25,000,000	100	104½	104¾
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage.	20,100,000	1,000	..	..
2d "	2,500,000	1,000	104	.
Rochester Gas & Elec. Co..	2,150,000	50	88	..
Preferred.	2,150,000	50	118	..
Consolidated 5's	2,000,000	..	104¼	1 5¼
San Francisco, Cal.	15,800,000	100	58¼	68¾
St. Joseph Gas Co.				
" 1st Mtg. 5's.	751,000	1,000	92	..
St. Paul Gas Light Co.	1,500,000	100	45	47
1st Mortgage 6's.	650,000	1,000	113	116
Extension, 6's.	600,000	1,000	112½	115
General Mortgage, 5's.	2,465,000	1,000	96¼	..
Syracuse, N. Y.	1,975,000	100	50	55
Bonds.	2,047 000	1,000	102	.
Washington, D. C	2,600,000	20	298½	29?¾
First mortgage 6's.	600,000	..	..	..
Western, Milwaukee.	4,000,000	..	..	..
Wilmington, Del.	600.000	50	230	.

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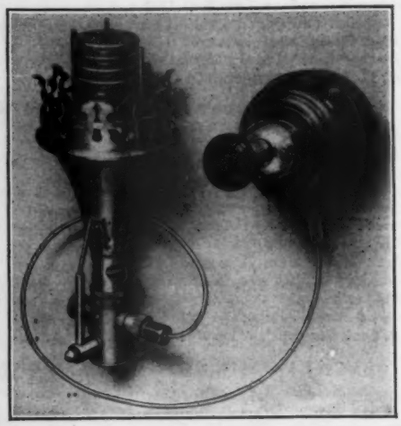

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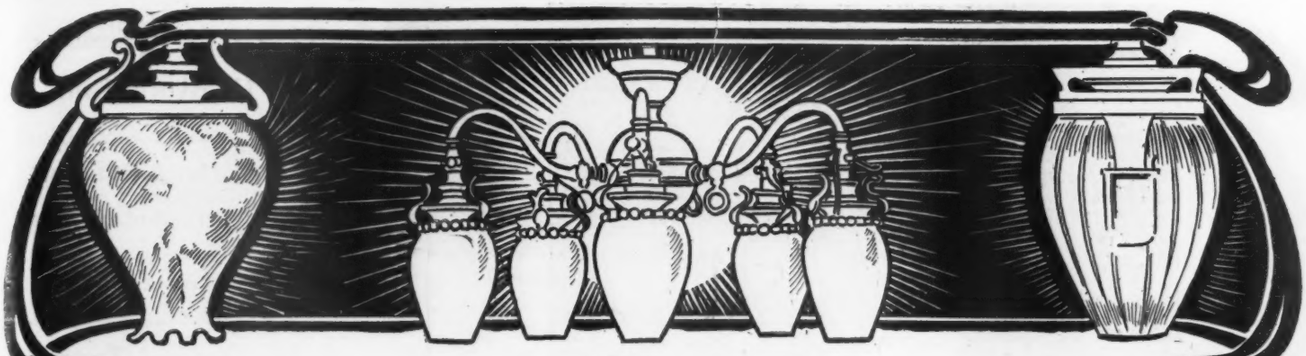

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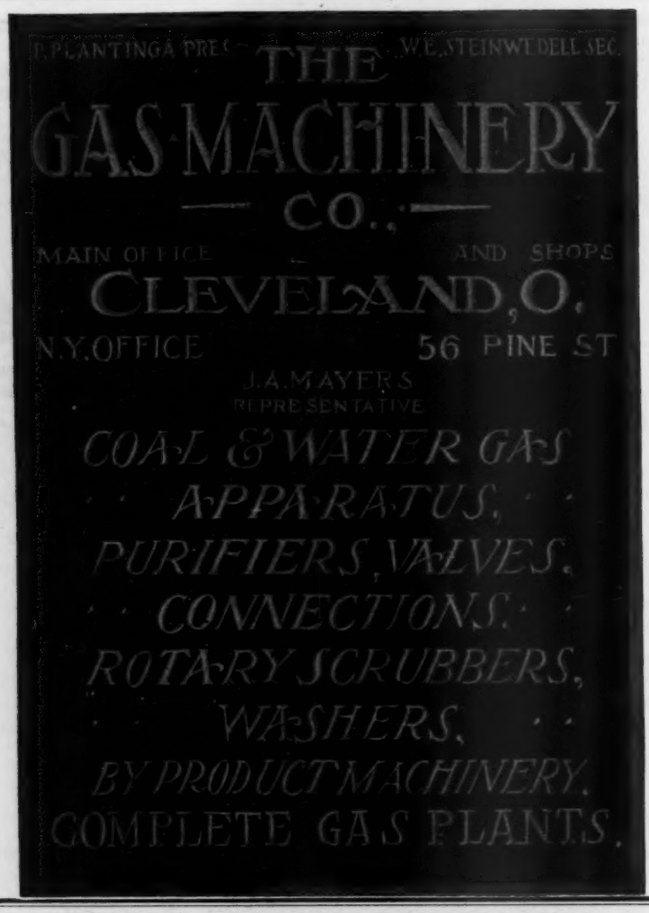

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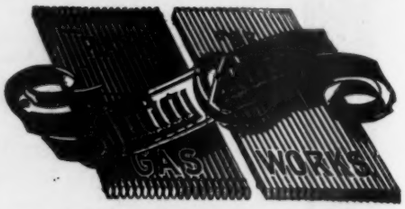
Reversible; Strongest; Most Easily Repaired.

Special Trays for Iron Sponge.



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We also Supply the Cheapest and Strongest

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Is the electrically operated, or trolley, system of transporting materials of any nature or size.

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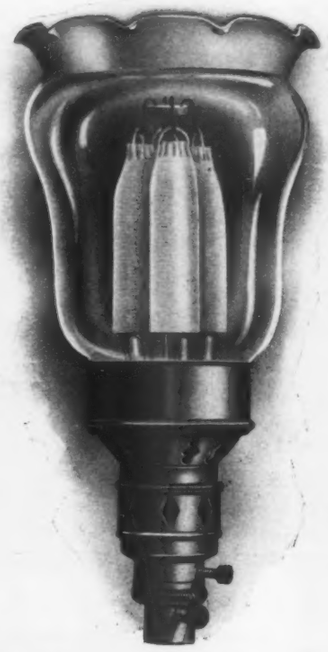

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The Reason Why.

YOU see, it's this way: When we tell you that the Martin Multiple Burner will give more light per cubic foot of gas consumed than any other burner made, you may say to yourself, "That's only what the maker claims."

But when we tell you that we will *positively guarantee* that the Martin Multiple Burner will give more light per unit of gas than any other burner, and that *we stand ready to prove it* by any and every test, then our proposition ought to command your serious attention. And when we finally tell you

THE REASON WHY

then you will realize the truth of our claim that *the Martin Multiple Burner solves the problem of incandescent gas lighting—solves it for everyone and solves it for you.*

DOORENBOS ARC No. 1.
BEST IN THE WORLD.

THE MARTIN MULTIPLE BURNER

is an open Bunsen having four burners, each with its own mantle. The absence of screens or caps increases efficiency by removing resistance.

The four small mantles also increase efficiency by providing a larger incandescent lighting surface. That's the whole thing in a nutshell.

It explains why *photometric tests show a superior efficiency of 25 per cent. to 30 per cent. for the Martin Multiple Burner over any other burner on the market.*

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BEST IN THE WORLD.

It has perfect control of both gas and air, can be instantly regulated to any gas, can be used on any gas fixture, has a standard fitter, and carries any glassware.

The Doorenbos Gas Arcs

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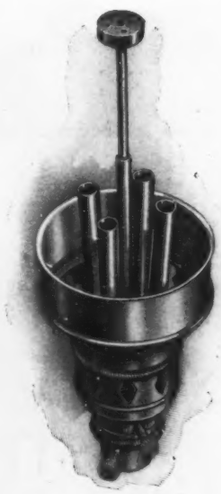

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NO CAPS OR SCREENS.

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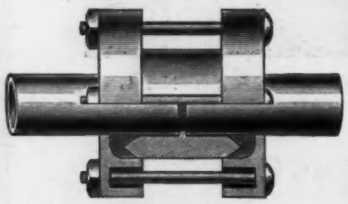
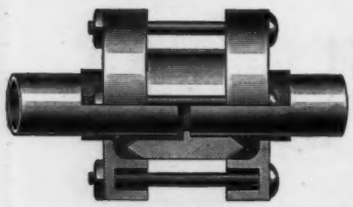
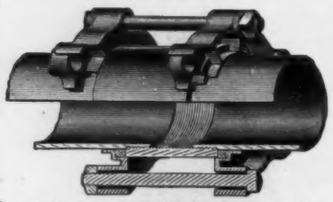


Regular Coupling, Style 1, for Plain End Wrought Iron Pipe.



Insulating Coupling, Style 5, for Plain End Wrought Iron Pipe,



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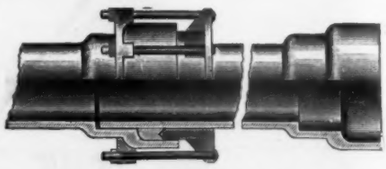
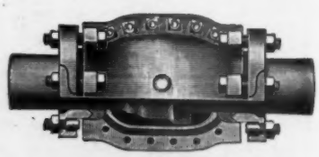
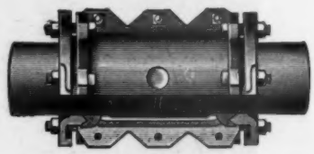


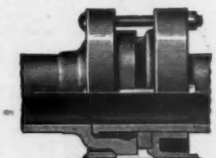
Coupling, Style 9, for Special Style Cast Iron Pipe.



Split Sleeve for Repairing Broken Bell on Cast Iron Pipe.



Split Sleeve for Repairing Broken or Cracked Cast Iron Pipe.



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For the convenience of Eastern gas companies and dealers we now have a full stock of Steward Burners and Lava Gas Tips in New York city. Your orders will be filled promptly.

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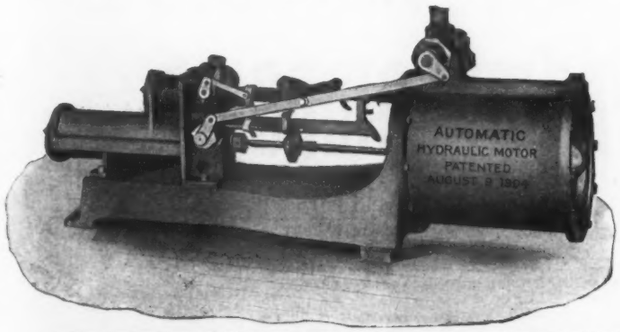

will more than double the candle power of the ordinary mantle light. Get particulars. Leased to consumers through gas companies only. An interesting and liberal proposition will be submitted to gas companies for the asking.

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For Structural Iron and Steel, Gas Apparatus, Underground Piping, Boiler Fronts, Stacks, etc.

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They are the Paints that Don't Come Off!

We let you Try before you Buy. Send for samples and prices.

AMERICAN STANDARD COMPOSITION COMPANY,

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THE FINEST COMBINED GAS HEATERS AND GAS HOT PLATE IN THE WORLD. THOROUGHLY PRACTICAL.

Heat with the whole of it.

COMPLETE SECTIONAL VIEW.

Cook with the half of it.

OPERATION.

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Price, dull nickel, per dozen....**$18.00**
Price, polished nickel, per dozen **24.00**
Not sold in less than dozen lots.

Liberal Discounts and Prompt Shipments. :: :: :: ::

Why not send us an order to-day for your season's requirements?

For every hot water need, use a Humphrey Crescent Instantaneous or an Automatic Water Heater. :: ::

Divides in the middle. No nuts, bolts or screws.

When not in use, or to pack, pull the legs out, untwist the burner and pull it out, tuck one-half of the jacket inside the other and lay the legs and burner in the bowl. A child can do it, and, when done, it occupies a very small space.

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Nickel Cylinder Lamps,

Used either with or without shades. Supplied with round or pear globes. :: ::

Just the lamp to offer the hesitating consumer who wants a different design.

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General Gas Light Co.

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AND HIGH PRESSURE GAS PUMPS BUILT BY

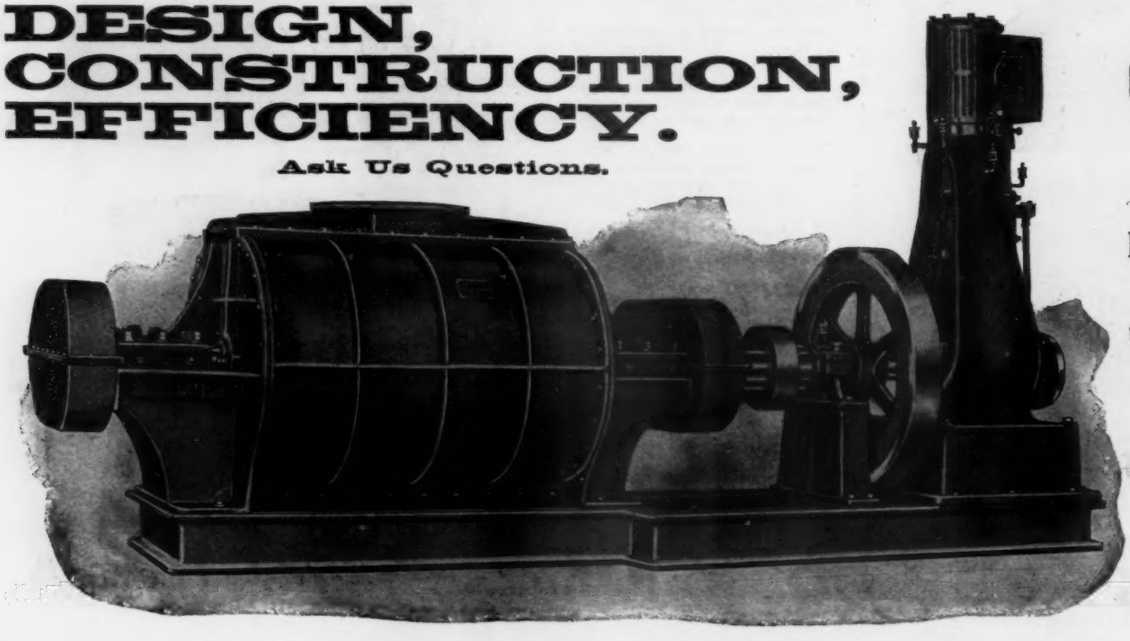
THE CONNERSVILLE BLOWER CO.

Stand so High in the estimation of those using them?

THE ANSWER IS IN THREE WORDS:

DESIGN, CONSTRUCTION, EFFICIENCY.

Ask Us Questions.



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IS NOW ON,

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THE BRAY BURNER
Is so well known, so thoroughly tried and so universally used that there is never a doubt as to what burner the gas man will use.

All the leading Gas Companies are and have been using

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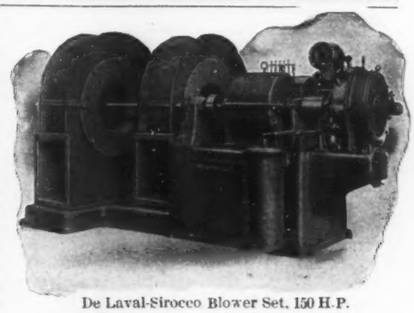
W. M. CRANE COMPANY,

Sole Agents for the United States. NEW YORK.



De Laval-Sirocco Blower Set, 150 H.P.

Steam Turbine Motors
Steam Turbine Dynamos
Steam Turbine Blowers
Steam Turbine Centrifugal Pumps
Electro-Motor Centrifugal Pumps

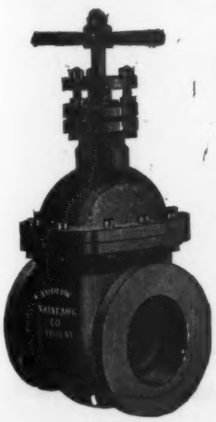
SEND FOR CATALOGUE.

REPRESENTATIVES:

D'Olier Engineering Co.,	New York City, Philadelphia, Pa.
Chas. Garrison,	Boston, Mass.
The Turbine Engineering Co.,	New York City, Chicago, Ill.
Denver Engineering Works Co.,	Denver, Col.
Florida Electric Co.,	Jacksonville, Florida.
Dravo, Doyle & Co.,	Pittsburg, Pa.
Geo. P. Dravo,	Milwaukee, Wis.
Chester B. Davis,	Dallas, Texas.
Joshua Hendy Machine Works,	San Francisco, Cal.
Kilbourne & Clark Co.,	Seattle, Wash.

DE LAVAL STEAM TURBINE COMPANY
Works and Sales Offices, TRENTON, N. J.

THE



Ludlow Valve Mfg. Co.,
TROY, N. Y., U. S. A.

Double and Single Gate Valves, ¼" to 72",

—FOR—

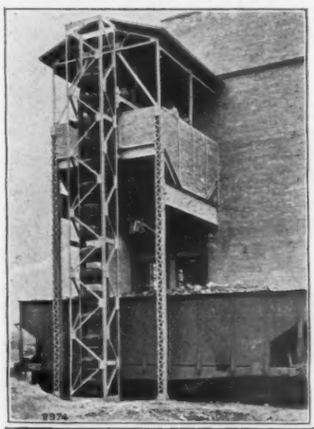
Gas, Water, Steam, Oil, Ammonia, Etc.

HOT GAS VALVES A SPECIALTY.

Send for Catalogue.

"INDUSTRIAL" RAILWAY AND CHARGING CARS

For Handling Coal in and around Gas Works.
Saves 50 per cent. in labor.
Examine our system. Described in Catalogue 038.
C. W. HUNT COMPANY, West New Brighton, N. Y.



The Dodge Conveyor
(PATENTED)

Handling Coal and Ashes at the Boiler House of the Penna. R. R. Co., South Altoona, Pa.

Simple, clean, practical, very flexible, and adaptable to almost every condition.
The only conveyor which catches the leakage and prevents accumulation of spilled material.
Write for a complete description.

THE LINK-BELT ENGINEERING CO.,
PHILADELPHIA.

NEW YORK: 49 Dey Street.
PITTSBURGH: Park Building.
CHICAGO: The Link-Belt Machinery Co.

THE ECONOMICAL GAS APPARATUS CONSTRUCTION COMPANY, LIMITED,

Consulting Engineers.

Builders of UP-TO-DATE Machinery and Appliances for Coal and Water Gas Plants. :: :: :: :: ::

PLANS,
SPECIFICATIONS
AND ESTIMATES
PREPARED.

AMERICAN OFFICE:
269 Front St., East, Toronto, Canada.

EMPIRE GAS IMPROVEMENT AND CONSTRUCTION CO.

This Company has purchased the patents and goodwill in the business hitherto carried on and owned by *A. M. Sutherland.* It is now ready to contract for the erection and installation of

ENTIRE GAS WORKS,

or any separate portion of the same, such as **Gasholders, Coal Gas Benches, Lowe-Sutherland** double-superheater **Water Gas Sets,** Scrubbers, Condensers, Exhausters, Purifying Boxes, Street Governors, Street Mains and Main Laying.

The high character of the work done by A. M. Sutherland during the past 15 years will be strictly adhered to and all work is warranted.

Mr. Sutherland remains with the Company for two years President and Director, and will give personal attention to contracts.

EMPIRE GAS IMPROVEMENT AND CONSTRUCTION CO., 49 Wall St., New York.

IMMERSION WASHERS.

A design embodying particularly desirable features.

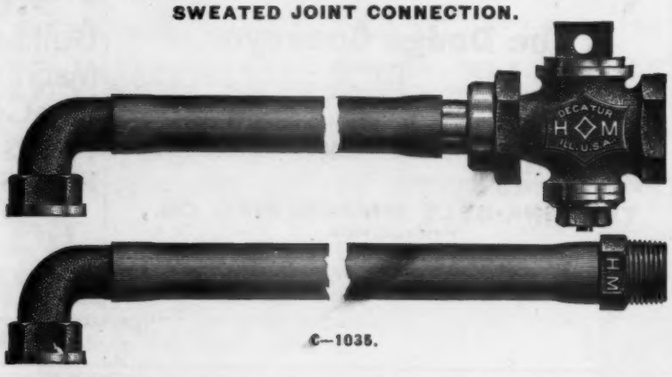
LLOYD CONSTRUCTION COMPANY,

Western Sales Agents for
BARTLETT, HAYWARD & CO., Baltimore, Md.

DETROIT, MICH.

MUELLER GAS METER CONNECTIONS.

SWEATED JOINT CONNECTION.



C—1035.

When you make your own meter connections you have two factors to contend with that makes them costly; first, lack of equipment for fast work, and second, the larger prices paid for material by purchasing in small quantities.

Mueller Sweated Joint Meter Connections are made by the use of special machines that enable one man to make them daily by hundreds, and the material is purchased in enormous quantities, which secures the lowest possible price. We make them for you much cheaper than you can make them yourself.

Mueller Sweated Joint Meter Connections are made with special pattern shouldered fittings, sweated into swedged lead pipe. They are made in 270 sizes and specifications. The connections illustrated have quarter bend meter couplings on one end and a male soldering nipple and union meter cock on the other.

Each set of connections is carefully inspected and assembled, is given a 75-pound hydraulic pressure test, bears the Mueller trade mark, and is *unconditionally guaranteed.*

We also make tapping machines and ground key work for gas works' use. Catalogues upon application.

Works and General Offices
DECATUR, ILL., U. S. A.
West Cerro Gordo St.

H. MUELLER MFG. CO.

Eastern Division
NEW YORK, N. Y., U. S. A.
254-258 Canal St. (Cor. Elm)

ROOTS' GAS EXHAUSTERS.

GOLD MEDAL AT ST. LOUIS, 1904.

Installation showing our latest improved machines, with flexible rope coupling, for large units.

SEND FOR CATALOGUE.

HOME OFFICE:
Connersville, Ind.

NEW YORK OFFICE:
120-122 Liberty St.

CHICAGO OFFICE:
1547 Marquette Building.

ARTHUR E. BOARDMAN, C.E.,

For several years associated with the late
CAPTAIN WILLIAM HENRY WHITE,
WILL CONTINUE THE BUSINESS OF

CONSULTING ENGINEER

For Gas, Water and Electric Light Companies, at
No. 41 Wall Street, Room 1707, New York.
TELEPHONE, 5534 BROAD.

FRANK D. MOSES,

Telephone, 204-A TRENTON, N. J., Telephone, 204-A

Constructing Engineer and Contractor.

Estimates Furnished on any kind of Work in Connection with Gas or Water Plants.
SPECIAL ATTENTION GIVEN TO THE REMODELLING AND EXTENDING OF THE PROPERTIES OF WORKS NOT UP-TO-DATE.
CORRESPONDENCE SOLICITED.

IMMERSION WASHERS.

A design embodying particularly desirable features.

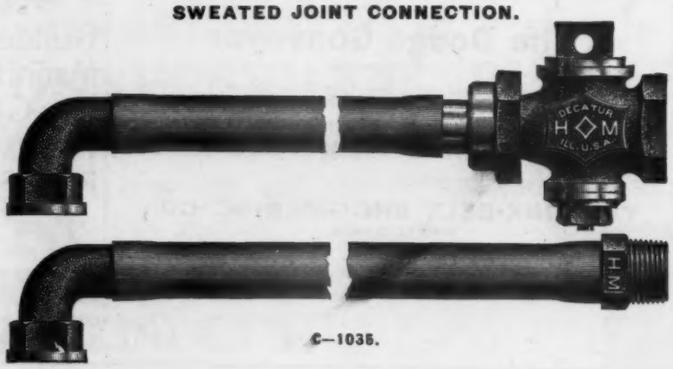
LLOYD CONSTRUCTION COMPANY,

Western Sales Agents for
BARTLETT, HAYWARD & CO., Baltimore, Md.

DETROIT, MICH.

MUELLER GAS METER CONNECTIONS.

SWEATED JOINT CONNECTION.



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CORRESPONDENCE SOLICITED.

GEORGE ORMROD, Mangr. & Treas., Emaus, Pa.
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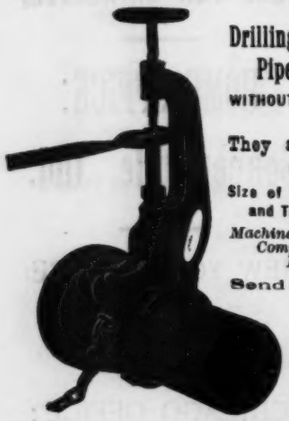
EMAUS PIPE FOUNDRY.
DONALDSON IRON COMPANY. EMAUS, PA.

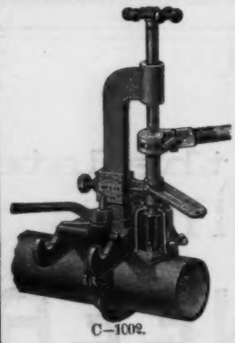
MANUFACTURERS OF
CAST IRON PIPE AND SPECIAL CASTINGS
FOR WATER AND GAS.
Also, FLANGE PIPE, LAMP POSTS, Etc.

GAS TAPPING MACHINES
—FOR—
Drilling and Tapping Pipe under Pressure
WITHOUT ANY ESCAPE OF GAS.
They are Strong and Compact.
Size of Combination Drills and Taps ¾ to 4-inch.
Machines Sent to any Gas Company for Thirty Days' Trial.
Send for Circulars.



Geo. Light,
DAYTON, O.

MUELLER COMBINATION TAPPING MACHINE.



The Mueller "Combination" Tapping Machine can be used with the gas cylinder for tapping under pressure, or without it for dry pipe tapping. This interchangeable feature makes it a very valuable tool for plants having both kinds of work to do with a small allowance for tools. Makes dry taps up to 3-inch and pressure taps up to 2-inch. Unconditionally guaranteed. Catalogues upon application.

C—1002.

H. MUELLER MFG. CO.,
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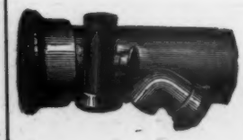
"THE MINER"
Globe Street and Boulevard Lamps.
Cheapest and Best
THOUSANDS IN USE WITH INCANDESCENT BURNERS.
Send for Catalogues.
THOMAS T. W. MINER,
821-823 Eagle Av., N. Y.

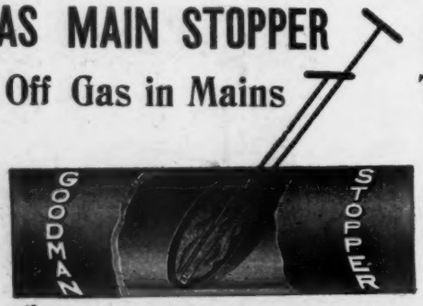
GASHOLDER TANKS AND GAS WORKS MASONRY COMPLETE.
Plans prepared and Estimates furnished at short notice.
J. P. WHITTIER,
va Street, Brooklyn, N. Y.

WARREN FOUNDRY AND MACHINE CO.,
Established 1856. Works at Phillipsburgh, N. J.
New York Office, 160 Broadway.



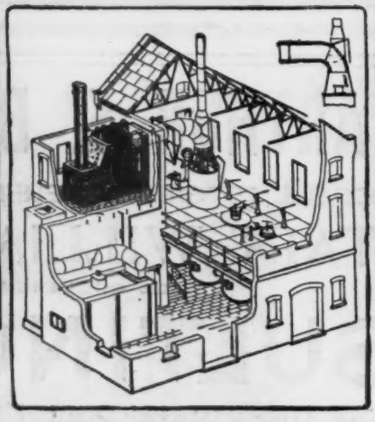
CAST IRON WATER AND GAS PIPE,
FROM THREE TO FORTY-EIGHT INCHES DIAMETER. ALSO, ALL SIZES OF
Flange Pipe for Sugar House and Mine Work. Branches, Bends, Retorts, etc., etc.

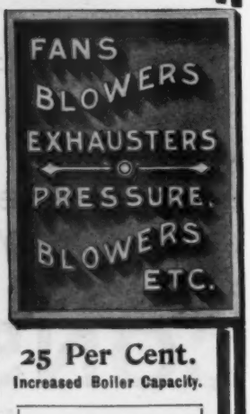
SAFETY GAS MAIN STOPPER COMPANY,
For Shutting Off Gas in Mains
Any size gas main can be shut off in 30 seconds. : : :



Temporarily during alterations and repairs. : : : :
STOPPERS SENT ON TRIAL.
Address: SAFETY GAS MAIN STOPPER CO., 1668 Park Ave., New York City.

GREEN'S ECONOMIZER





25 Per Cent. Saving in Fuel.
25 Per Cent. Increased Boiler Capacity.
Our Expert Advice Free.
Installation in Poughkeepsie works, where it is saving this amount of fuel, and at the same time increasing the boiler efficiency as stated.
Send for Catalog.
THE GREEN FUEL ECONOMIZER CO., MATTEAWAN, N. Y.

GEORGE R. ROWLAND,
Formerly with the Continental Iron Works.
Draughtsman and Constructing Engineer.
Drawings, Specifications and Estimates furnished for the construction of new works or alteration of old works. Special attention given to Patent Office drawings.
Office, No. 245 Broadway, N. Y. City.

J. F. W. JOST,
CHEMICAL ENGINEER
—IN—
GAS MANUFACTURE,
P. O. BOX 2043, PHILADELPHIA, PA.

GAS ANALYST'S MANUAL,
By JAQUES ABADY, M. Inst. Mech. E.
(Incorporating F. W. Hartley's "Gas Analyst's Manual" and "Gas Measurement.")
Ninety-three Illustrations and Nine Folding Plates. Bound in Handsome Half Leather. Price, $6.50.
For Sale by **A. M. CALLENDER & Co., 42 Pine St., New York City.**

AMERICAN METER CO.,

NEW YORK, ST. LOUIS, PHILADELPHIA, SAN FRANCISCO, CHICAGO,

Photometrical and Experimental Apparatus.

PUBLIC LIGHTING TABLE.

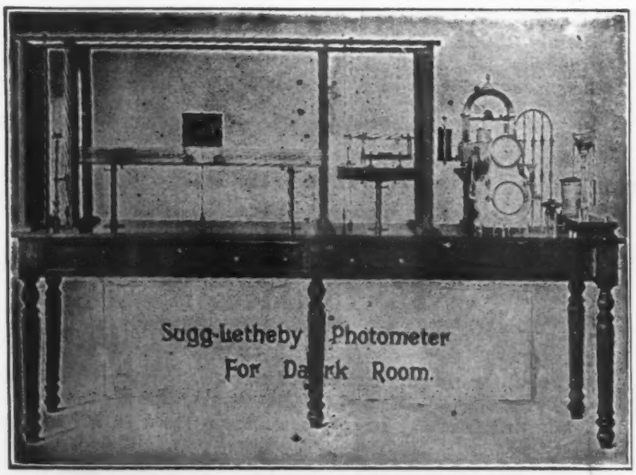
NOVEMBER, 1905.

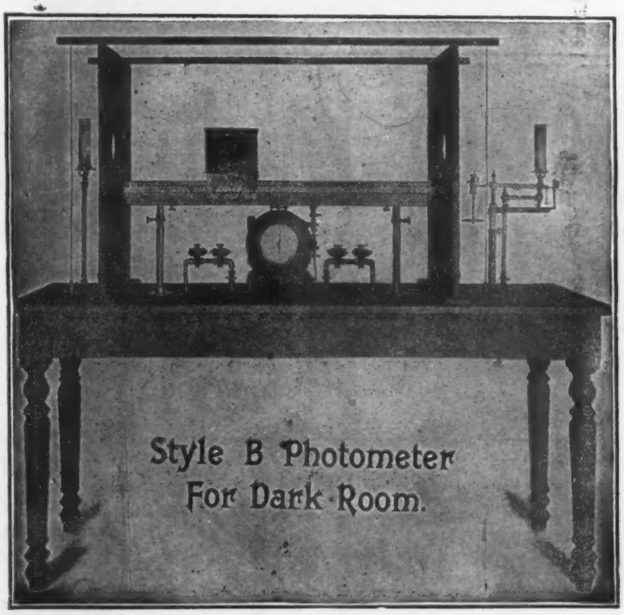
Day of Week.	Date.	Table No. 1. FOLLOWING THE MOON. Light.	Extinguish.
Wed.	1	8.10 PM	5.30 AM
Thu.	2	9.10	5.30
Fri.	3	10.10 FQ	5.30
Sat.	4	11 10	5.30
Sun.	5	12.10 AM	5.40
Mon.	6	1.10	5.40
Tue.	7	2.00	5.40
Wed.	8	3.00	5.40
Thu.	9	4.00	5.40
Fri.	10	No L.	No L.
Sat.	11	No L. FM	No L.
Sun	12	No L.	No L.
Mon.	13	5.10 PM	7.10 PM
Tue.	14	5.10	7.50
Wed.	15	5.10	8.30
Thu.	16	5.10	9.30
Fri.	17	5.10	10.20
Sat.	18	5.10	11.20
Sun.	19	5.10 LQ	12.30 AM
Mon.	20	5.10	1.30
Tue.	21	5.10	2.40
Wed.	22	5.10	3.50
Thu.	23	5.10	5.50
Fri.	24	5.10	5.50
Sat.	25	5.10	5.50
Sun.	26	5.10 NM	6.00
Mon.	27	5.10	6.00
Tue.	28	5.10	6.00
Wed.	29	5.10	6.00
Thu.	30	5.10	6.00

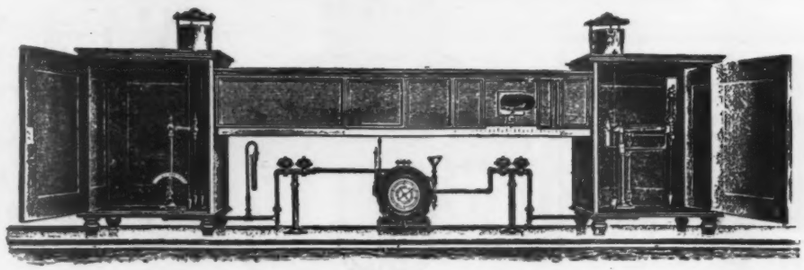
TOTAL HOURS DURING 1905.

By Table No. 1.

	Hrs.Min.
January	240.50
February	192.20
March	207.00
April	175.10
May	161.00
June	139.50
July	149.00
August	161.50
September	173.00
October	205.00
November	211.00
December	229.00
Total, yr.	2245.00







Closed Photometer For Light Room.

CIRCULARS SENT ON REQUEST.

PUBLIC LIGHTING TABLE.

NOVEMBER, 1905.

Day of Week.	Date.	Table No. 2. NEW YORK CITY. ALL NIGHT LIGHTING. Light.	Extinguish.
		P. M.	A.M.
Wed.	1	4.45	5.35
Thu.	2	4.45	5.35
Fri.	3	4.45	5.35
Sat.	4	4.45	5.35
Sun.	5	4.40	5.45
Mon.	6	4.40	5.45
Tue.	7	4.40	5.45
Wed.	8	4.40	5.45
Thu.	9	4.40	5.45
Fri.	10	4.40	5.45
Sat.	11	4.40	5.45
Sun.	12	4.30	6.00
Mon.	13	4.30	6.00
Tue.	14	4.30	6.00
Wed.	15	4.30	6.00
Thu.	16	4.30	6.00
Fri.	17	4.30	6.00
Sat.	18	4.30	6.00
Sun.	19	4.25	6.00
Mon.	20	4.25	6.00
Tue.	21	4.25	6.00
Wed.	22	4.25	6.00
Thu.	23	4.25	6.00
Fri.	24	4.25	6.00
Sat.	25	4.25	6.00
Sun.	26	4.20	6.10
Mon.	27	4.20	6.10
Tue.	28	4.20	6.10
Wed.	29	4.20	6.10
Thu.	30	4.20	6.10

TOTAL HOURS DURING 1905.

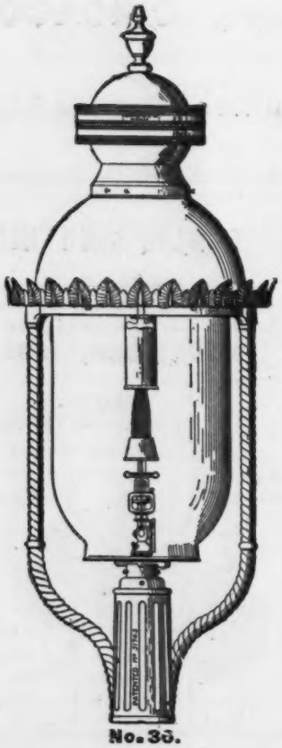
By Table No. 2.

	Hrs.Min.
January	423.20
February	355.25
March	355.35
April	298.50
May	264.50
June	234.25
July	243.45
August	280.25
September	321.15
October	374.30
November	401.40
December	433.45
Total, yr.	3987.45

NEW YORK, 97 Liberty Street. BOSTON, 814 Beacon Building. PHILADELPHIA, Broad and Arch Streets. ST. LOUIS, 712 Roe Building. CHICAGO, Foot of Orleans Street. SAN FRANCISCO, 712 Polk Street.

WELSBACH STREET LIGHTING COMPANY

.... OF AMERICA ....



No. 36.

Controls and Operates the

Welsbach System of Street Lighting,

Which includes its specially DESIGNED AND PATENTED BURNER for STREET and PARK LIGHTING exclusively.

Uniformly SUCCESSFUL in 150 Cities and Towns.

By means of the Welsbach System of street lighting the superiority of GAS over electricity for street lighting has been fully demonstrated.

POINTS OF MERIT:

It is { Economical, Attractive, Successful, Up-to-date.

IT LIGHTS THE STREET.

Where there are no gas mains we can furnish an equally good light by our SELF-GENERATING NAPHTHA WELSBACH BURNER, and thereby supply a uniform light in all localities.

Correspondence Solicited from Gas Companies and Others interested in Municipal and Outside Lighting.

No. 38.

The Welsbach No. 6 Harp Fixture.

AN IDEAL LIGHT FOR DINING OR LIVING ROOMS.

THE HIGHEST MECHANICAL INGENUITY COMBINED WITH ORNAMENTAL BEAUTY--THE NEWEST OUTPUT FROM THE WELSBACH FACTORIES.

Equipped with new model No. 66 high candle power Welsbach Burner.

Side Pilot By-pass Tube covered with refractory sleeve to prevent bending.

Fourteen-inch Opal Dome Shade.

Polished Brass Embossed Crown 2¼ inches high.

Length of Fixture, 30 inches.

Width of Harp, 4½ inches.

Finished in Polished Brass.

Packed One Dozen to the Case.

List Price, per Dozen, $45 00.

We recommend equipping the No. 6 Harp Fixture with No. 4197 Intensive Brand Mantle, and the No. 306 **F. Q. M.** Clear Glass Air-Hole Cylinder.

Although the 14-inch Opal Dome Shade is standard equipment, we are prepared to furnish Dome Shades in green, pink or yellow (opal lined), and will be glad to quote prices.

WELSBACH CO.,

Salesrooms in all the principal cities of the United States.

Factories:
GLOUCESTER, N. J.
CHICAGO, ILL.

THE UNITED GAS IMPROVEMENT COMPANY

For the Period Ending July 1st, 1905, has been Awarded Contracts for 32 Sets of

Standard Double-Superheater Lowe Water Gas Apparatus.

PARTIAL LIST OF PLACES:

Catasauqua, Pa.	**Hempstead, N. Y.** (2d contract).	**Amsterdam, N. Y.**
Plattsmouth, Neb.	**Lansdale, Pa.**	**Houston, Tex.** (2d contract).
Detroit, Mich. (2d contract).	**New Britain, Conn.**	**Hamilton, O.** (2d contract).
Springfield, Ills.	**Ludington, Mich.**	**Indianapolis, Ind.** (2d contract).
Oneonta, N. Y. (2d contract).	**New York,** Mutual Co. (2d contract).	**Hazleton, Pa.**
Pottsville, Pa. (2d contract).	**St. Louis, Mo.** (4th contract).	**Mahanoy City, Pa.**
Evansville, Ind. (2d contract).	**Sioux City, Ia.** (3d contract).	**Nanticoke, Pa.**

TOTAL SETS TO JULY 1ST, 1905, ... 585
TOTAL DAILY CAPACITY TO JULY 1ST, 1905, . 455,980,000 CU. FT.

The United Gas Improvement Company,

Broad and Arch Streets, Philadelphia.

Established 1858. Incorporated 1890.
CHAS. E. GREGORY, Prest. DAVID R. DALY, V.-Prest. & Treas.
H. D. ABERNETHY, Sec.

J. H. Gautier & Co.

Greene & Essex Streets,
Jersey City, N. J.

MANUFACTURERS OF

CLAY GAS RETORTS, FIRE CLAY TILES,
FIRE BRICK and FIRE CLAY SPECIALTIES.

Ground Fire Clay, Fire Sand and Ground Fire Brick in Barrels and Bulk.

SOLE MANUFACTURERS OF THE

FLEMMING GENERATOR GAS FURNACE

Brooklyn Fire Brick Works,

OFFICE AND WORKS:
88 VAN DYKE ST., BROOKLYN, N. Y.
MANUFACTURERS OF

CLAY GAS RETORTS & SETTINGS, GENERATOR LININGS. SPECIALTIES.

ST. LOUIS GAS CONSTRUCTION CO.,

DESIGNERS AND BUILDERS OF

COAL GAS BENCHES,

SPECIAL HIGH GRADE REFRACTORY MATERIAL FOR BENCH SETTINGS AND WATER GAS LININGS.

SOLE AGENTS FOR

CHRISTY SETTINGS.

CORRESPONDENCE SOLICITED.

ST. LOUIS, MO.

FIELD'S ANALYSIS FOR THE YEAR 1904.

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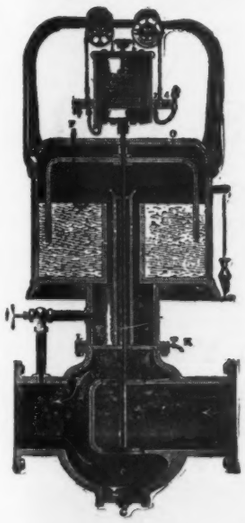

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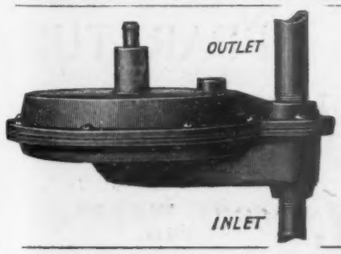

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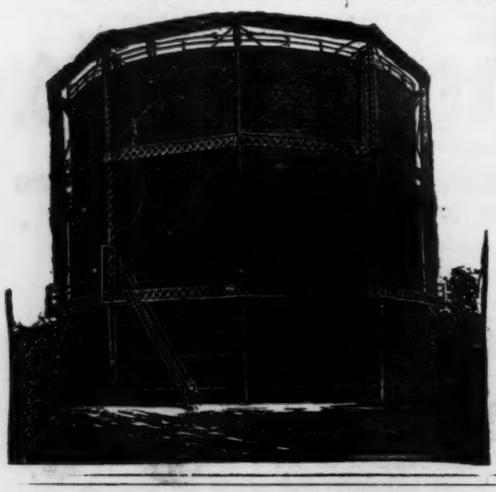

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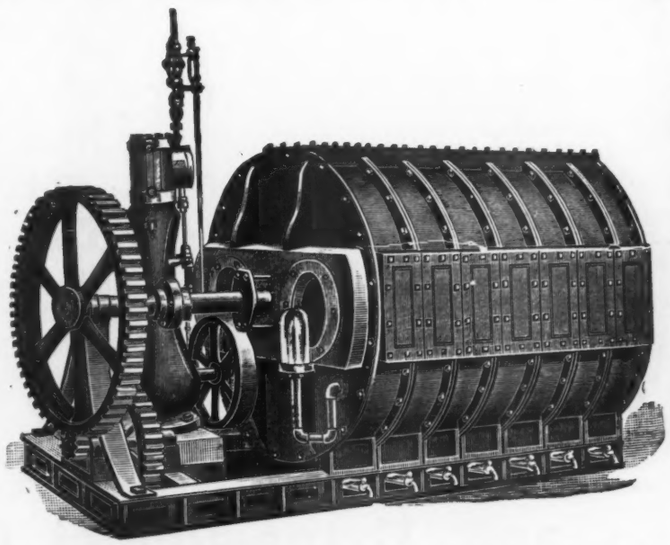

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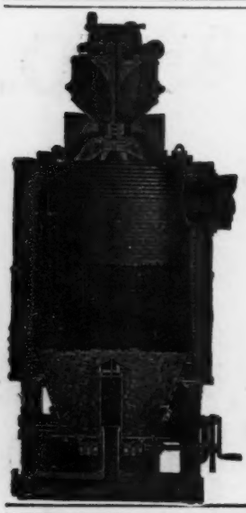

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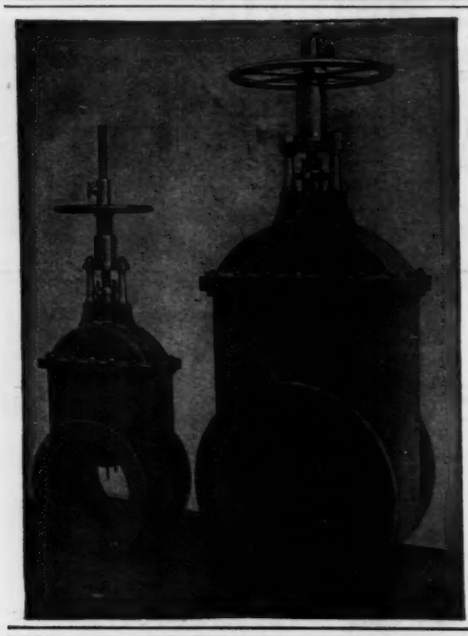

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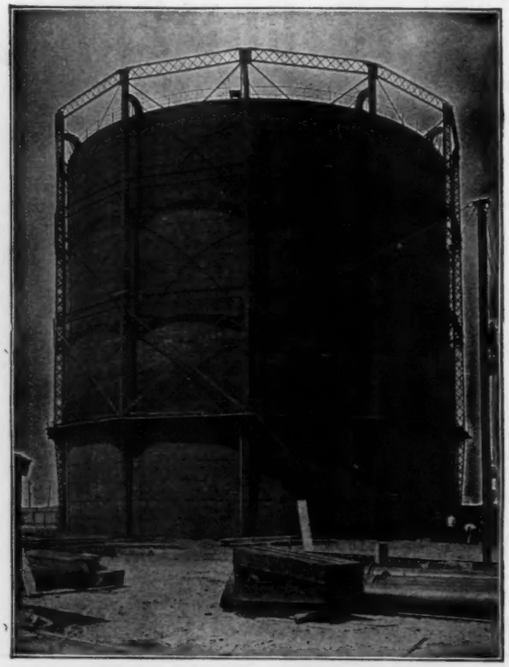

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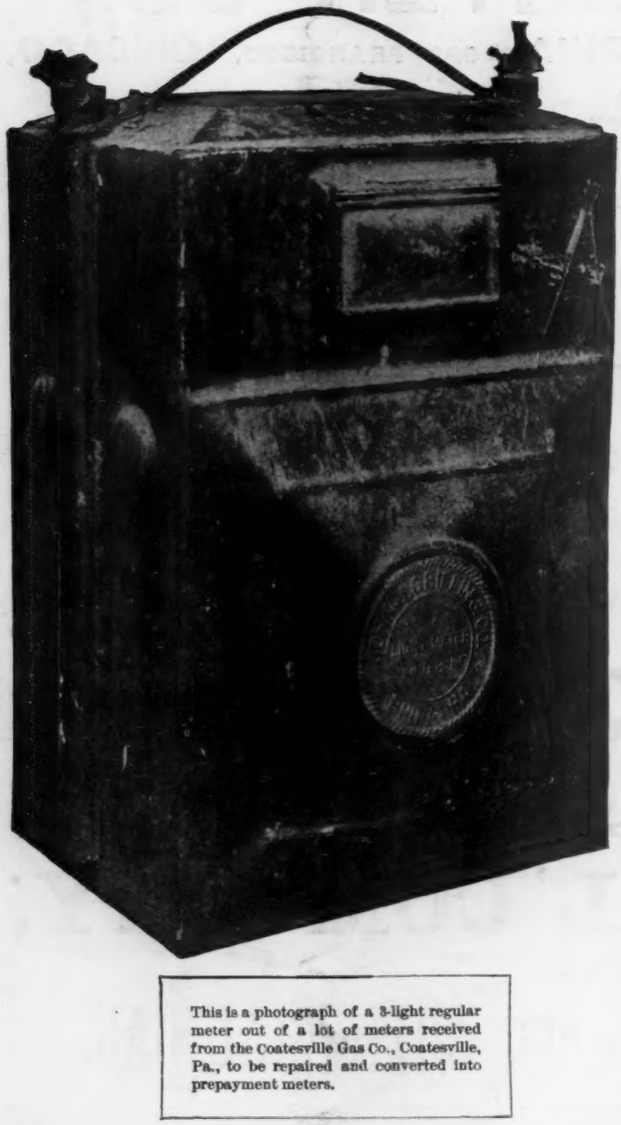

This is a photograph of a 3-light regular meter out of a lot of meters received from the Coatesville Gas Co., Coatesville, Pa., to be repaired and converted into prepayment meters.

AFTER.

This is the same meter after it has been repaired and converted into a new prepayment meter.

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